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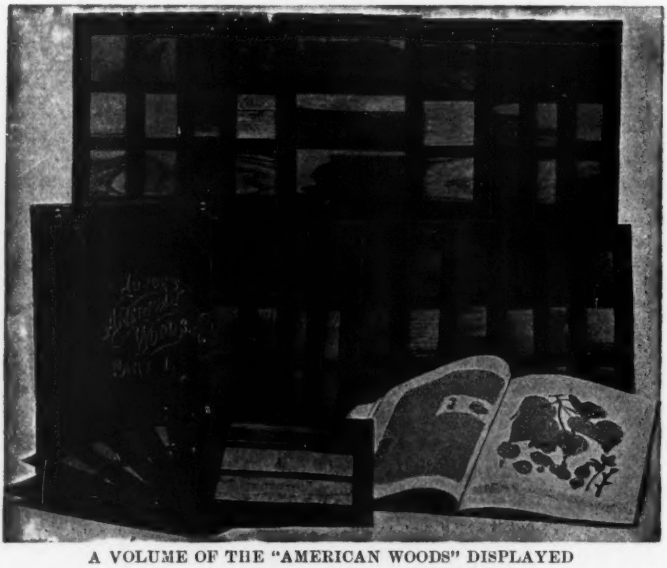

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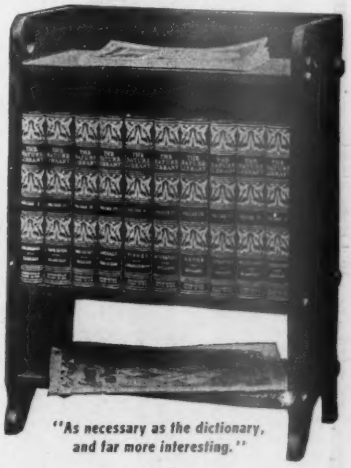

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Forestry and Irrigation

H. M. SUTER, Editor

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JOHN E. SHERIDAN

Scene in the Teton Forest Reserve, Wyoming.

Forestry and Irrigation.

VOL. X. NOVEMBER, 1904. NO. 11.

AMERICAN FOREST CONGRESS

Washington, D. C.

JANUARY 2, 3, 4, 5, 6, 1905.

OFFICIAL CALL.

An American Forest Congress under the auspices of the American Forestry Association will meet in Washington, D. C., January second to sixth, 1905.

The purpose of this Congress is to establish a broader understanding of the forest in its relation to the great industries depending upon it; to advance the conservative use of forest resources for both the present and the future need of these industries; to stimulate and unite all efforts to perpetuate the forest as a permanent resource of the Nation.

All who are interested in securing these ends are urged to attend this Congress.

The fact that the President of the United States will address the Congress and receive its members is significant of its national importance, while the promised attendance of many of the foremost men of our industrial life assures definite and far-reaching results from its deliberations.

The Congress will include:

Members of the United States Senate and House of Representatives.
Ambassadors, Ministers, and other representatives of foreign nations.
Governors of States and Territories.
Members of the Society of American Foresters.
Faculties of Forest Schools.
State Forest officials.
Professional foresters in private work.
100 Delegates from the American Forestry Association.
Editors of Lumber and other Trade Journals of industries dependent upon the forest.
25 Delegates from the Bureau of Forestry of the U. S., Department of Agriculture.
25 Delegates from the United States Geological Survey.
50 Delegates from the United States General Land Office and Forest Reserve Service.
75 Delegates from the National Irrigation Association.
75 Delegates from the National Irrigation Congress.
5 Delegates from each Forestry Association, State or local.
10 Delegates from the Canadian Forestry Association.

5 Delegates from the Canadian Forest Service.
5 Delegates appointed by the Governor of each State and Territory.
5 Delegates from each Lumberman's Association.
5 Delegates from each Wood-working Association.
5 Delegates from each Mining Association.
5 Delegates from each Stockmen's Association.
5 Delegates from each Turpentine Association.
2 Delegates from each Railroad, Telegraph, or Telephone Company.
15 Delegates from the American Society of Civil Engineers.
15 Delegates from the American Institute of Mining Engineers.
Chiefs of Bureaus and Divisions of the United States Department of Agriculture.
2 Delegates from each Chamber of Commerce and Board of Trade.
Delegates-at-large appointed by the President of the Congress from forest landowners and those who have rendered distinguished service to the cause of American Forestry.

On Monday at 12 o'clock noon, January 2, the delegates will be received in a body at the President's New Year's reception at the White House.

Morning and afternoon sessions will be held on January 3, 4, 5, and 6. A subject of wide industrial importance will be discussed at each session by men whose experience and standing qualify them to speak authoritatively upon it.

The subjects, each of which will receive attention at a separate session, are :

1. Relation of the Public Forest Lands to Irrigation.
2. Relation of the Public Forest Lands to Grazing.
3. The Lumber Industry and the Forest.
4. Importance of the Public Forest Lands to Mining.
5. Forestry in relation to Railroad Supplies.
6. National Forest Policy.
7. State Forest Policy.

The sessions of the Congress will be held in the National Rifles Armory, 920 G Street, northwest, which has a seating capacity of eight hundred. All meetings at this hall will be open to the public. On the afternoon of January 5 a special meeting will be held in the Lafayette Theatre, which will be addressed by the President of the United States and other men prominent in our industrial and National life. Admission to this meeting will be by ticket.

A rate of one and one-third fare for the round trip, on the certificate plan, has been granted by nearly all railroads in the United States and Canada in case one hundred persons attend the Congress. In order to secure this rate delegates must procure certificates at starting points.

The headquarters of the Congress will be maintained at the National Rifles Armory for the registration of the delegates, the issuance of membership certificates, and the general information and convenience of those in attendance.

The co-operation of all newspapers and other publications is requested in giving wide publicity to this Official Call and in directing attention to the national importance of this Congress.

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Subjects to be Considered.

1. Relation of the Public Forest Lands to Irrigation.
2. Relation of the Public Forest Lands to Grazing.
3. The Lumber Industry and the Forest.
4. Importance of the Public Forest Lands to Mining.
5. Forestry in Relation to Railroad Supplies.
6. National Forest Policy.
7. State Forest Policy.

NEWS AND NOTES.

Interest in the Congress

The general interest which is being manifested in the American Forest Congress, to be held in Washington, D. C., January 2 to 6, as announced in both the October and the present issues of FORESTRY AND IRRIGATION, is especially gratifying to those in charge of the arrangements. Prominent men throughout the country have signified their intention of being present and participating in the deliberations of the Congress, and the committee is particularly encouraged by the commendatory tone of the letters received, as evidencing sincere and widespread interest in forestry and recognition of its importance to the country. The time set for the congress is an especially favorable one in that it permits the attendance of the recognized authorities in forestry and its kindred subject, irrigation, who are employed in the Bureau of Forestry and the United States Reclamation Service. The field season for each of these branches of the government service do not end until late in the year, and the presence in Washington of those who have had actual experience and training in forestry and irrigation should lend particular interest to proceedings of the congress. Mr. F. H. Newell, Chief Engineer of the Reclamation Service. and Mr. Charles D. Walcott, Director of the U. S. Geological Survey, will be present and enter actively into the work of the congress, and Hon. Jas. Wilson, Secretary of Agriculture and President of the American Forestry Association, under the auspices of which the congress is held, will act as presiding officer during its several sessions.

Arrangements are now in progress to secure the attendance of students in forest courses at the various colleges throughout the country, and it is probable that the entire classes at the Yale Forest School, the Biltmore Forest School, and probably those in the forestry department of the University of Michigan will attend.

As announced in the official call on another page of this issue, President Roosevelt will deliver the principal address at one of the sessions. The interest of prominent men in the West is especially worthy of mention. Governor Pardee of California though detained in his State at the time of the congress, owing to the sessions of the State Legislature, has written to state his unqualified approval of the objects of the convention, and his sincere interest in practical forestry. E. S. Gosney, one of the foremost grazing experts of the Southwest, will come as a delegate from Arizona; Mr. F. J. Hagenbarth, president of the National Live Stock Association, will attend, as will Mr. Howard Elliott, President of the Northern Pacific Railroad; Senator Thomas R. Bard, of California; Mr. N. M. McLeod; H. A. Jastro, General Superintendent of the Kern County Land Company, of California; and Mr. Victor H. Beckman, Editor of the *Pacific Lumber Trade Journal.*

Among the other prominent men who will be present are: John Hays Hammond; Colonel W. S. Harvey, Vice President of the Pennsylvania Forestry Association; Mr. John Joy Edson; Representative Lamb of Virginia; Senator F. M. Simmons; Hon. H. B. F. Macfarland, President Board of Commissioners, District of Columbia; Baron Speck von Sternburg German Ambassador to the United States: Commissioner Richards, of the General Land Offioce; Senator Redfield Proctor of Vermont; Mr. Garrett Schenck, President of the Great Northen Paper Company; Senator Scott of West Virginia; Mr. George K. Smith, Secretary of the National Lumber Manufacturers' Association; Mr. Thomas F. Walsh, President of the National Irrigation Association; Dr. B. L. Wiggins, Vice-chancellor the University of the South; Dr. Albert

Shaw, editor of *"The Review of Reviews,"* Hon. Whitelaw Reid, and many others.

Indications point to an attendance of 1,000 delegates, and the congress should mark the beginning of an era of a more thorough interest and appreciation in practical forestry.

Yale Forest School

This year for the first time the Junior Class of the Yale Forest School came together in July at Milford, Penn. Usually the Juniors have met in New Haven in September. The purpose of adding a summer term to the Junior year is to give an opportunity for a greater amount of field work in forest mensuration and silviculture than was possible under the previous conditions. The summer term opened July 1 and continued until September 10. The experiment was an unqualified success and fully met the anticipations of the officers of the school. Prof. H. S. Graves conducted the work, assisted by Mr. E. E. Carter, now Instructor in Forestry in Harvard University. The addition of a summer term to the course at Yale is one of the most important steps taken since the establishment of the school, not only because the efficiency of the courses in forest mensuration and silviculture have been emphatically increased, but also because the change has permitted the addition of several new courses and the rearrangement of the old courses. The most important new courses are forest engineering by Assistant Prof. R. L. Marston, and Physiography by Prof. H. E. Gregory. Some further important changes will be announced in the new catalogue which will be issued in a few weeks.

The equipment of the Forest School at Milford, Penn., has been very much extended during the past season. A new lecture hall and a permanent dining hall and kitchen have been erected through the generosity of Mr. James W. Pinchot and his family; and the number of tents has been increased to nearly fifty. The school now has at Milford a very thorough equipment for the summer work.

The Summer School of the University, which has been conducted at Milford since 1901, held an extremely successful session this year. The students live in camp with the Juniors of the regular department, but the instruction is entirely separate. The work was conducted by Prof. J. W. Toumey, assisted by Mr. A. H. Graves, Instructor in the Yale Forest School. Sixteen students were in attendance.

The total registration at the Yale Forest School this fall is sixty-three, or one less than last year at this time.

Biltmore Forest School

The new courses offered by this school during the year 1904-1905 comprise a course in denrology, a course in forest entomology, a course in forest pathology, a course in forest zoology, a course in irrigation and its interdependence with forestry, a course on the forest work conducted by the Federal Government. All of these courses are to be given by specialists in the employ of the United States Government at Washington.

The attendance at the school at the present time is fifteen. Mr. Clifton D. Howe has been appointed assistant forester and instructor in botany. The Biltmore saw mills will work on Avery's Creek during the year. The cutting of tannin wood, of tanbark and of wood for the Asheville market will be conducted in the present year as during the past. A shingle plant will be added to the equipment of the wood splitting mill at Biltmore.

The nurseries have been increased during the last year and are now stocked with several million pines (white and yellow) and several hundred thousand hardwoods. The stock raised in these nurseries will be largely used for the reforestation on the Bent Creek Estate, near Biltmore, comprising 15,000 acres.

Michigan Agricultural College

At the Michigan Agricultural College fifteen young men have entered with the expectation of completing the forestry course. Of these seven are from Michigan, four from New York, and each of the following named states are represented by one student: Ohio, Indiana, Mississippi, and California. Twenty-three men in the freshman year of the five-year agricultural course are receiving instruction in the elements of the subject. All the work in the junior and senior years will be given this year with little modification of last year's programme. The two men who graduated from this course last June have been employed during the summer by the State Forestry Commission. Regular meetings of the organization known as the M. A. C. Foresters will be held during the year. This organization is composed of the students in the forestry course and others especially interested in the subject. The meetings are held each alternate week and the discussions are led by some advanced student or by a special lecturer. The officers are Chief Forester, Chief of Records Account, Forest Ranger, Executive and Programme Committees.

University of Maine

The undegraduate course in forestry at the University of Maine had, during the college year of 1903-4, an enrollment of forty-five students who elected courses in forestry. Of this number four made this subject their major course, with a view of taking it up as a profession. At the opening of the present college year the number of students who have chosen forestry as a profession has been increased to ten.

In Iowa

For some years the professor in charge of the Department of Horticulture and Forestry at the Iowa State College of Agriculture and Mechanics Arts has given an elementary course in Forestry, but this past year the college decided to enlarge the work by introducing several courses bearing especially upon farm forestry. Mr. H. P. Baker, of the Bureau of Forestry, was elected as Assistant Professor in charge of Forestry and Forest to the Experiment Station, and assumed control of the work on September 1. Half of his time will be given to the College work and the other half to studying Iowa forest conditions for the Bureau of Forestry.

So far three courses have been established, which are as follows:

Course I. *Elementary Forestry.* This course will be a discussion in a brief way of Forestry and its objects, with the main portion of the course given to a study of trees and tree planting in Iowa, touching on the subject of wood, its structure, uses, and preservation. This work will be a four-hour study for the first semester of the sophomore year and will be eventually required of all agricultural students. This fall forty men are taking the course.

Course II. *Silviculture.* This is an elective course in the Junior year for those who have completed Course I. Nine men have taken up this work, which consists of three hours of lectures and three hours field work during the entire semester. In this course will be discussed the distribution and character of native forests and factors of tree growth and tree planting in Iowa; the management of the farm wood-lot and its protection from fire, etc., with a brief discussion of forest measurement, and timber and its uses.

Course III. *Forest management and Policy* will be an elective in the Senior year for those who have taken Courses I and II, and is designed for the men who wish to enter Forestry as a profession. This course will take up simple questions of forest management in their application to the farm grove or woodlot. Under forest policy will be discussed land policies, forest ownership, forest history, state and national forestry, and irrigation and forestry.

A fourth course is being prepared as an elective for Civil Engineer students, a number of whom have asked that such a course be given. This work will be a study of summer and winter characteristics of common trees, with a study of the structure and identification of woods found on the ordinary market.

The work will be broadened and strengthened by work in the Department of Entomology by Prof. H. E. Summers, and in the Department of Botany by Prof. L. H. Pammel, bearing directly upon the subject of Forestry.

Half of Professor Baker's time will be given to the work of the Experiment Station, which is just beginning a series of experiments in co-operation with the Bureau of Forestry in methods of treating soft wood fence posts, such as soft maple, willow, and cottonwood. From 800 to 1,000 posts have been donated by farmers of the state, and the results are being watched with a great deal of interest. The fence post problem is a big one in the state of Iowa, and immense numbers of posts are used annually by the farmers and stockmen at a large expense. Exhibition plots of the various trees adapted to Iowa conditions will be started next spring and various experiments in growing and handling tree seedlings will be carried on.

University of Michigan

Forest work at the University of Michigan continues under direction of Professor Roth, assisted by Professor Davis. Under Professor Roth's direction the courses in forestry at this institution made an excellent start, and with the larger result of arousing throughout the state a much needed sentiment in favor of forest preservation. The opening of the new collegiate year finds the attendance at Michigan increased over that of last.

A City Planting a Forest

Los Angeles, Cal., has 3,000 acres of brush land called Griffith Park, which it intends to convert into a commercial forest. This will be the first instance of a city in the United States creating a forest. The practice is quite common in Europe, where the forest-parks have not only contributed to the pleasure of the people, but have been more than self-supporting through their timber output. Under its cooperative offer the Bureau of Forestry had last summer at Los Angeles four of its experts, making a comprehensive planting plan for the forest. This plan was completed at the end of September. The idea is to convert a waste piece of land into a productive forest, which will not only pay for its creation and care through the sale of mature timber, but will prove a constant source of pleasure and recreation for the citizens of Los Angeles. It is an entirely practical plan, and Los Angeles deserves credit for its progressive spirit. Other cities could very profitably follow this excellent example.

An Example in Forestry

The Pocono Manor Association of Pennsylvania has 700 acres, covered principally with a dense growth of chestnut and chestnut oak sprouts, which it intends to improve by forestry. This Association has spent a large sum of money in erecting buildings and improving the conditions of its grounds for the comfort and pleasure of its members during the summer months. The tract of land is on Little Pocono Mountain, about 20 miles north of Delaware Water Gap, and is at present in a very bad condition. It was lumbered some forty years ago, and has been burnt over periodically about once every four or five years since then. Its present tree growth is only brush from 6 to 10 feet high—and not always that. Thinning must be done, and also some planting in the bare places.

The greatest need is protection from fires. At the Association's solicitation, the Bureau of Forestry, early in 1903, made plans for the improvement and protection of the 700 acres. These plans are now being put in opera-

tion. Their special significance will be in showing what can be done by forestry where ax and fire have done their worst in impoverishment of both soil and timber. As very much of the country, not only in that part of the State, but in many other regions of the East, shows the effects of the same evils, the reclamation of this tract of land will offer a splendid object lesson, and should be encouragement for work of the same kind elsewhere.

Timber Seasoning Stations

The Bureau of Forestry has recently signed an agreement to make extensive timber seasoning tests in two Western States, in cooperation with two telegraph and telephone companies. Experimental stations will be located at Marinette, Wis., and Escanaba, Mich.; and probably a third station will be established at Ashland, Wis. The expense of the experiments will be borne jointly by the Bureau and the companies. Cedar and tamarack telephone and telegraph poles will be furnished by the State of Wisconsin free of cost, and two railroad companies have agreed to haul them to the experiment stations without charge for freight.

The object of the experiments is to determine how many years can be added to the life of each pole by proper seasoning. Since millions upon millions of poles are used along telegraph and telephone lines, even one year's extra service for each pole will amount to a tremendous saving in expense. Unseasoned cedar poles last from twelve to fifteen years. Seasoning experiments have shown how to increase this time by three or four years, and it is now expected to improve on this increase. Past methods of seasoning have effected a drying out of 20 per cent of the original weight of the poles.

Report of Reclamation Service

The Second Annual Report of the Reclamation Service, which was compiled under the supervision of Mr. F. H. Newell, chief engineer, is now available. It is a continuation of the First Annual Report, which was completed on November 29, 1902, and transmitted at the opening of the second session of the Fifty-seventh Congress. The statements made in the first report are supplemented in the second by an account of the results accomplished during the field season of 1903 by Mr. Newell and his assistants.

The present report opens with a discussion of the reclamation law and the application of its various provisions under existing conditions. In transmitting the report to the Secretary of the Interior, the Director of the United States Geological Survey states that a practical application of the provisions of the law has shown them to be effective, and that so far as can be seen, at the present time, no further legislation is required, as the law seems to have sufficient scope to accomplish its purpose. Following the exposition of the law comes a statement of decisions made by the Secretary of the Interior relating to the Reclamation Service. These refer to withdrawal of lands, limitation of the areas of homestead entries, the establishment of water rights, the purchase of lands, the reservation of rights of way, supervision over right of way applications, the ordering of public-land surveys, etc. The various State and local agencies organized to assist in carrying out the reclamation law are also briefly described.

The bulk of the report consists of detailed descriptions, arranged in alphabetical order, by States and Territories, of the operations in the field. These descriptions are by the district engineers in charge of the operations. Mr. Arthur P. Davis writes of the investigations made in Arizona and New Mexico; Mr. J. B. Lippincott, of the work in California; Mr. A. L. Fellows, of the investigations in Colorado; Mr. D. W. Ross, of those in Idaho; Mr. W. G. Russell, of those in Kansas; Mr.

Cyrus C. Babb, of the investigations in Montana; Mr. L. H. Taylor, of the work in Nevada; Mr. F. E. Weymouth, of the work in North Dakota; Mr. Ferdinand Bonstedt, of the investigations in Oklahoma; Mr. John T. Whistler, of those in Oregon; Mr. C. H. Fitch, of those in South Dakota; Mr. G. Swendsen, of the work in Utah; Mr. T. A. Noble, of the investigations in Washington; and Mr. John E. Field and Mr. Jeremiah Ahern, of the investigations in Wyoming.

Within the year actual construction was begun in Nevada on a large canal from Truckee River. In Arizona preliminary construction was commenced on the Salt River dam, which will furnish water to arid lands in the vicinity of Phoenix. In other States and Territories plans and specifications are in various stages of progress. Everywhere the work is being pushed as rapidly as is consistent with a full knowledge of conditions and with economical administration.

Awakening in Illinois.

Readers of FORESTRY AND IRRIGATION will be interested in learning the action taken upon forest matters by the Illinois Federation of Women's Clubs at the State meeting held at Danville October 18-21. This meeting was largely attended, and was one of the most successful in the history of the Federation. The forestry subjects on the programme were: "What Forestry Means to Illinois Through the Work of the Forestry Committee of the Federation," by Mrs. P. S. Peterson, of Chicago; "Forest Life—Habitat and Sojourner," by Mrs. E. C. Lambert, of Jacksonville; "A Forest Policy for Illinois," by R. S. Kellogg, of Bureau of Forestry.

The Federation also indorsed bills for the establishment of a Department of Forestry at the State University and the creation of a State Forest Reserve. There is good reason to think that action of some kind along forestry lines will be secured at the next session of the Legislature.

Forest Nusery in Minnesota.

Regarding the spruce and pine nursery on on the Pillsbury forest reserve sixteen miles north-west of Brainerd, which has just been inspected by General Andrews and Professor Green, both of the executive committee of the Minnesota State Forestry Board, the former reports that:

The nursery is a carefully cultivated and fenced acre, in which principally Norway spruce seeds were sown in long beds last spring. The Norway spruce came up fairly well. In many of the beds the rows are full of thrifty plants. The white pine and white spruce did not come up as well. The trees vary from an inch to three inches in height and we estimated that there are about a million of them.

The sight of so many young trees perfectly free from weeds was most pleasing. Half the nursery is covered with lath screens and the other half with brush screens on poles resting on firmly-set posts eight feet high. This shade has tinged the whole floor of the nursery with green moss—an interesting picture. The screens were planned by Professor Green, and were made by Lars Hope, the nursery keeper, in workman-like manner, and will last several years.

The nursery being half a mile from Mr. Hope's residence, he was unable to prevent some of the seeds after they were sown from being consumed by blackbirds and gophers. To dispatch the rest, Mr. Hope put into their holes paper saturated with bisulphide of carbon. To the blackbirds he issued a few rations of millet mixed with Paris green with desired effect.

Before snow falls these seedlings will receive a thin cover of hay. Before they are over two years old they should be taken up and set where they are to remain permanently. It is believed that spruce for pulp will yield quicker returns than any other tree on cut-over lands or light soil, and probably the Minnesota Forestry Board will experiment in growing spruce on a part of the Pillsbury land if the next legislature will furnish means for doing so.

Irrigation Engineers Wanted. The United States Civil Service Commission announces an examination on November 22-23, 1904, at the places mentioned in the accompanying list, to secure eligibles from which to make certification to file vacancies as they occur in the position of irrigation engineer in connection with the irrigation and drainage investigations in the Office of Experiment Stations, Department of Agriculture. The initial salary will be from $1,500 to $2,000 per annum, according to qualifications.

The examination will consist of the subjects mentioned below, weighted as indicated:

Two days will be required for this examination, and the age limit is 20 years or over.

This examination is open to all citizens of the United States who comply with the requirements.

Applicants should at once apply either to the United States Civil Service Commission, Washington, D. C., for application Form 1312. No application will be accepted unless properly executed and filed with the Commission at Washington. In applying for this examination the exact title as given at the head of this announcement should be used in the application.

As examination papers are shipped direct from the Commission to the place of examination, it is necessary that applications be received in ample time to arrange for the examination desired at the place indicated by the applicant. The Commission will, therefore, arrange to examine any applicant whose application is received in time to permit the shipment of the necessary papers.

Laws Against Water Pollution. A review of the laws forbidding the pollution of inland waters in the United States, which may be of great practical benefit to the public, has been prepared by Mr. Edwin B. Goodell for the United States Geological Survey.

Mr. Goodell's purpose has not been to prepare a complete work on water pollution for the use of members of the bench and bar, but rather to put into the hands of public officials, legislators, water companies, manufacturers, farmers, and others interested in the subject, a guide for their action, and to furnish references to the sources from which a more exhaustive knowledge of the subject may be obtained if required.

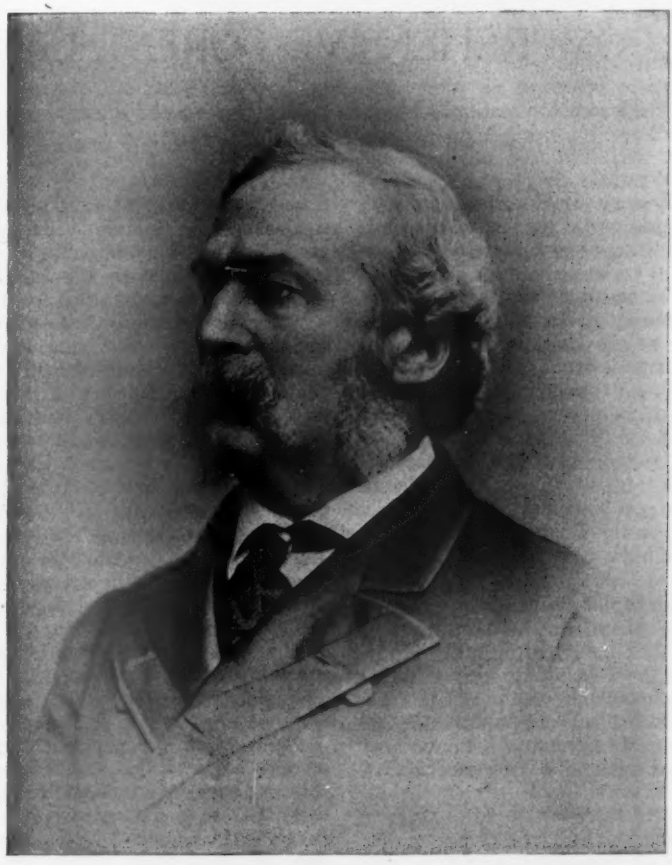
No attempt has been made to present a detailed statement of the entire law against water pollution as it exists independently of statutes, but the broad legal principles under which anti-pollution statutes become operative are explained, and important court decisions are quoted to show authority for various deductions. These principles and decisions have been classified and are presented in three groups:

(1) The rights of riparian owners to pure water as against one another.

(2) The rights of the public (as distinguished from individual owners) to have inland waters kept free from pollution by riparian owners or others.

(3) The conditions under which, and the extent to which, public municipalities may use inland waters in the disposal of sewage matter from public sewers.

The statutes enacted in various States are classified according to their general scope and an opportunity is thus afforded to compare their effectiveness and desirability. In some States there is nothing more than a simple provision making it a crime to poison wells and springs, while in others elaborate provisions have been made to check and, so far as possible, absolutely prevent all pollution of all waters by the refuse products of animal life or the waste of human industry. In citing the statutes, Mr. Goodell has grouped the States together logically to show the stage of growth in sanitary education at which each has arrived.



MR. JAMES W. PINCHOT,

AMONG THE FIRST TO ADVOCATE THE INTRODUCTION OF FORESTRY IN THE UNITED STATES AND ONE OF THE FOUNDERS OF THE YALE FOREST SCHOOL.

ONE of the earliest advocates of the conservative handling of the forests of the United States, and a man whose services to the cause of forestry have grown with each succeeding year, is Mr. James W. Pinchot. His interest in the forest has been life-long as he was born in northeastern Pennsylvania in the palmy days of the lumber trade in that section, and much of his early life was spent in the woods. Mr. Pinchot many years ago perceived the necessity of doing something to preserve our rapidly disappearing forests, though, like many others since, just what should be done was not readily apparent. During a visit to France he first saw forestry practiced and was at once struck by the value and necessity of introducing similar methods in America. He advised his son, Mr. Gifford Pinchot, to make forestry his profession, a suggestion that was followed with the result that to-day the latter is Forester of the United States Department of Agriculture, and the recognized leader of the forest movement in this country.

Mr. Pinchot was born in 1831, went to New York in 1850 and went into business. He soon became the intimate personal friend of artists like Sanford, Gifford, McEntee, Whittredge, Kensett, Church, Eastman Johnson, Weir, and others.

He was one of the early members of the Century Club, and one of the early subscribers to the Metropolitan Museum. He was also a member of the Chamber of Commerce for many years and the first treasurer and a member of the Executive Committee of the American Committee for the Statute of Liberty. With other members of his family, he founded the Yale Forest School in 1900 and immediately after the Yale Summer School of Forestry. Later, with the officers of the school, he established the Milford Forest Experiment Station. Both for the Summer School and for the Experiment Station he has given land and buildings, and another large building is now in course of erection.

A COMPREHENSIVE FOREST LAW

Drawn for State of California by the Bureau of Forestry; Contains Principles that Can be Applied in Other States.

The Bureau of Forestry has been cooperating with the State of California for two years past in order to determine on a sound state forest policy. The result of this work is now condensed into a forest bill to be considered by the California Legislature at its next session. This bill contains an outline of principles which the Bureau feels might properly form the basis for a general forest law for other states, modified, of course, to meet peculiar local conditions. It is based not only on the study in California, but also in the Bureau's experience in its work to date, throughout the country.

Owing to the wide interest in forest matters, especially in working for proper forest legislation, and the difficulties in securing it, it is felt that the publication of this proposed California forest law will be of value to readers of FORESTRY AND IRRIGATION. For that reason it is given in full elsewhere.

An act to provide for the protection and management of forest land within the State of California.

Sec. 1. *State Board of Forestry.*—There shall be a State Board of Forestry, consisting of the Governor, Secretary of State, Attorney General, Secretary of Agriculture, and State Forester, which shall supervise all matters of State Forest policy and management and convene upon call of the Governor or of its Secretary.

Sec. 2. *State Forester and His Duties.*—There shall be a State Forester, who shall be a technically trained forester, appointed by the Governor; and whether any candidate for this position is a technically trained forester shall be determined by certificate from the Forester of the United States Department of Agriculture. He shall receive a salary of $2,500 per year, or as much additional as shall, from time to time be allowed by the legislature for good and continued service; be supplied with necessary office room, equipment, clerical and field assistants; be reimbursed for all traveling and field expenses incurred in the conduct of his official business; act as Secretary of the State Board of Forestry; and be removed from office only for cause shown. He shall, under the supervision of the State Board of Forestry, execute all matters pertaining to forestry within the jurisdiction of the State; direct the management of State parks and forests; collect data relative to forest fires; prevent and extinguish forest, brush and grass fires; enforce all laws pertaining to forest or brush covered land, and commence prosecutions for violation of such laws; cooperate with land owners as described in section 4 of this act; supervise such courses in forestry at educational institutions as may hereafter be provided for by law; and publish from time to time such information on forestry as he may deem wise. He shall prepare annually a report to the Governor on the progress and condition of State forest work and recommend therein plans for improving the State system of forest protection, management, and taxation.

Sec. 3. *Supervison and Care of State Parks.*—The Yosemite Valley State Park, the Big Basin Redwood Park, the Mount Hamilton Tract, the Santa Monica Forest Station, and the Chico Forest Station, together with all money heretofore or hereafter appropriated for the purchase of land for or care of said parks, tracts and stations, shall be in charge of the State Board of Forestry, and said Board shall forthwith have all the powers and

duties now possessed in accordance with law by persons or commissions with regard to the State parks, tracts of land and forest stations mentioned in this act, and also of any forest land which may hereafter become permanent State property, or be placed definitely in the care of the State, and it is hereby enacted that, if the Governments of the United States shall, at any time, donate or entrust to the State of California for State park or State forest reserve purposes any tract or tracts of wholly or partially wooded land, such tract or tracts of land shall be administered at the expenses of the State, as provided by law for the State parks now in existence, or hereafter created.

Sec. 4. *Cooperative Work.*—The State Forester shall, upon request and whenever he deems it necessary to the best interests of the people and the State, cooperate with counties, towns, corporations, and individuals to devise plans for the protection and management of trees, wood lots, and timber tracts, on consideration and under an agreement that the parties obtaining such cooperation pay at least the field expenses of experts employed in preparing said plans.

Sec. 5. *Publication of Laws and Notices.*—The State Forester shall prepare and print for public distribution an abstract of all State forest laws, together with such rules and regulations in accord therewith as he may deem necessary, and shall annually print and distribute a list of all Fire Wardens, with their addresses. He shall also furnish notices, printed in large letters on linen, calling attention to the danger from forest fires and to forest fire and trespass laws and their penalties. Such notices shall be posted by the Fire Wardens in conspicuous places along every highway in brush or forest covered country, at frequent intervals along streams and lakes frequented by tourists, hunters and fishermen, at established camping sites, and in every post office in the forested region.

Sec. 6. *Assistant State Forester.*—There shall be an Assitant State Forester, who shall be a technically trained forester, appointed by the State Forester, with the approval of the State Board of Forestry. He shall receive a salary of $1,500 per year and all traveling and field expenses incurred in the conduct of his official business. He shall perform such duties as may be assigned to him by the State Forester, whose place he shall fill during any disability or absence of the State Forester.

Sec. 7. *Chief and Assistant Chief and District Fire Wardens.*—The State Forester shall be Chief Fire Warden, and the Assistant State Forester shall be Assistant Chief Fire Warden. The Chief Fire Warden shall have charge of the District Fire Wardens, and all the Fire Wardens of the State, and aid and direct them in their duties. There shall be District Fire Wardens at salaries of $1,000 each per annum and necessary traveling and field expenses, salaries and expenses to be paid half by the State and half by the counties composing the districts. Their expenses, when approved by the State Forester, and their salaries, when due, shall be audited and paid directly by the State, the amounts due from the several counties to be paid into the State treasury upon demand; such amounts to be apportioned among the counties composing the respective districts pro rata according to the assessed valuation of the real estate in such counties. They shall be appointed by the State Forester, with the approval of the State Board of Forestry for each of ten districts, the boundaries of which are to be determined from time to time by the State Forester, with the approval of the State Board of Forestry; and, furthermore, any county or combination of less than four counties shall be made a separate fire district upon request of the County Board or Boards of Supervisors, in which case such special fire district shall pay two-thirds and the State one-third of the cost of maintaining its District Fire Warden.

Sec. 8. *Duties of District Fire Wardens.*—The duties of District Fire

Wardens shall be to devote their entire time to State forest interests, according to rules and directions to be determined by the State Forester, with approval of the State Board of Forestry. They shall take prompt measures to prevent and extinguish forest fires, keep a record of the cause, extent, and damage of all forest fires in their respective districts, and perform such other duties as the State Forester may direct.

Sec. 9. *Voluntary Fire Wardens and Their Duties.*—Each District Fire Warden shall appoint, subject to the approval of the State Forester, in such number and localities as he deems wise, public-spirited citizens to act as Voluntary Fire Wardens. They shall promptly report all fires to the respective District Fire Wardens and take immediate and active steps towards their extinguishment, report any violation of the forest laws, and assist in apprehending and convicting offenders, and give all possible assistance to the District Fire Wardens. For such services payment shall be made by the State at the rate of 25 cents per hour for the time actually employed, provided that payment for such services shall not be made to any Federal forest reserve officials, who act as Fire Wardens, and shall not in any case exceed $50 for one year. The Supervisors and Rangers on the Federal forest reserves within the State, whenever they formally accept the duties and responsibilities of Fire Wardens, shall be appointed as Voluntary Fire Wardens, and shall have all the powers given to Fire Wardens by this act.

Sec. 10. *Powers and Requirements of Fire Wardens.*—All Fire Wardens shall have the powers of peace officers to make arrests, without warrant, for violations of any State or Federal forest laws. Any Fire Warden who has information which would show, with reasonable certainty, that any person had violated any provision of such forest laws, shall immediately take action against the offender, either by using his own powers as a peace officer, or by making complaint before the proper magistrate or by information to the District Attorney, and shall obtain all possible evidence pertaining thereto.

Sec. 11. *Assistance and Compensation of Citizens in Fighting Fires.*—All Fire Wardens shall have authority to call upon able-bodied citizens, between the ages of 16 and 50 years, in the territory in which they act, for assistance in putting out fire, and any such persons who refuse to obey such summons, unless prevented by good and sufficient reasons, shall be liable to a fine of $15, to be collected in action for debt by State prosecution to be made by the Fire Warden who issued the summons. Compensation for services rendered in fighting fire shall be at the rate of 20 cents per hour for the time actually employed, one-half to be paid by the State and one-half by the county in which fire occurred. The Fire Warden in charge shall submit time record and bill of the men employed to the District Fire Warden, who shall examine and forward it, immediately, to the State Forester, with approval or criticism. The State Forester, if he approves the bill, shall forward it at once to the State Auditor, who shall pay it in full, as soon as audited and found correct, one-half due from the county to be collected afterwards by the State. Fire Wardens shall assist, with the help of the citizens at their disposal, in extinguishing fires either wholly or partly in adjacent counties. In the case of fire fighting outside the county in which citizens reside, the summoning Fire Warden shall note the fact in his record and bill of the men employed and the State Auditor shall charge only one-third of the amount, due from the counties for any particular fire, to the county from which the men were summoned to the adjacent county, the other two-thirds being chargeable against the county in which the fighting was actually done. The District Fire Wardens shall have power to incur expense for the transportation and other expenses of fire fighters, and shall include the same, with necessary vouchers, in his account. Such expenses shall be paid

by the State Auditor and apportioned among the counties as provided for expenses earlier in this section.

Sec. 12. *Fire Patrol.*—In times and localities of particular fire danger, the State Forester shall maintain a fire patrol, through the District Fire Wardens, at such places in brush or forest land as the public interest may require, two-thirds of the expense of such patrol to be paid by the county and one-third by the State.

Sec. 13. *District Attorneys to Prosecute Vigorously.*—Whenever an arrest shall have been made for violation of any provision of this act, or whenever any information of such violation shall have been lodged with him, the District Attorney of the County in which the criminal act was committed must prosecute the offender or offenders with all diligence and energy. If any District Attorney shall fail to comply with the provisions of this section he shall be deemed guilty of a misdemeanor, and, upon conviction, shall be fined not less than $100 nor more than $1,000, or be imprisoned not less than thirty days nor more than one year, or both, in the discretion of the court. The penalties of this section shall apply to any magistrate, with proper authority, who refuses or neglects to cause the arrest and prosecution of any person or persons when complaint, under oath, of violation of any terms of this act has been lodged with him.

Sec. 14. *Destruction of Warning Notices.*—Any person who shall maliciously or thoughtlessly destroy, deface, remove or disfigure any sign, poster or warning notice posted under the provisions of this act shall be guilty of a misdemeanor and punishable upon conviction by a fine of not less than $15 nor more than $100, or imprisonment in the county jail for a period of not less than ten days nor more than three months, or both.

Sec. 15. *Wilfully, Maliciously or Negligently Setting Forest Fires.*—Every person who wilfully, maliciously or negligently sets on fire or causes or procures to be set on fire any woods, brush, prairies, grass, grain or stubble on any lands not his own, or allows a fire to escape from his own land, whereby any property of another is injured or destroyed, or accidentally sets any such fire or allows it to escape from his control without extinguishing it, or using every effort to extinguish it, shall be deemed guilty of a misdemeanor, and upon conviction shall be fined not less than $50 nor more than $5,000, or imprisoned not less than thirty days nor more than five years, or both. Setting such fires or allowing them to escape shall be prima facie proof of wilfulness, malice or neglect under this section; provided, that nothing herein contained shall apply to a person who, in good faith, sets a back fire to check a fire already burning.

Sec. 16. *Civil Liability for Forest Fires.*—In addition to the penalties provided in sections 15, 17, 18 and 19 of this act, the United States, the State, the County, or private owners, whose property is injured or destroyed by such fires, may recover, in a civil action, double the amount of damages suffered; in case the fires were willful or malicious, or in case such fires were caused or escaped accidentally or unavoidably, civil action shall lie only for the actual damage sustained, as determined by the value of the property injured or destroyed and the detriment to the land and the vegetation thereon. The presumption of wilfulness, malice or neglect shall be overcome, provided the person leaving a fire, under section 17, uses reasonable precaution to extinguish it; or, under section 19, the precautions provided in that section are observed; or, under section 18, fires are set with permission of and under direction of the District Fire Warden, during the "dry season;" or, during the wet season, fires are not set until after one full day's notice is given to each and every adjacent land owner.

Sec. 17. *Extinguishment of Camp Fires.*—Every person who, upon departing from a camp or camping place, in brush or forest land, wilfully or negligently leaves fire burning or unextinguished, or who upon building

such fires does not take proper precautions to prevent its spread, whereby it might be communicated to brush or forest land and do damage, shall be subject to a fine of not less than $50 nor more than $250, with costs of suit and collection; and if the defendant or defendants refuse or neglect to pay the fine and costs imposed, or make satisfactory arrangement for the payment of same within thirty days, he or they shall be confined in the common jail of said county for a period not less than thirty nor more than sixty days.

Sec. 18. *Restructions of Use of Fire in Dry Season.*—It shall be unlawful, during what is locally known as the "dry season (this to be considered as the period between May 15 and the first soaking rains of autumn), for any person or persons to burn brush, stumps, logs, fallen timber, fallows, brush, grass or forest covered land, grain, or stubble, or blast wood with dynamite, powder or other explosives, or set off fireworks of any kind in forest or brush-covered land, either their own or the property of another, without permission of and under the direction or supervision of the District Fire Wardens; these restrictions not to apply to the ordinary use of fire or blasts in logging redwood, nor in cases where back fires are set in good faith to stop an existing fire. Violations of these provisions shall be a misdemeanor, punishable upon conviction by a fine of not less than $50 nor more than $1,000, or imprisonment not less than thirty days nor more than one year, or both. Persons or corporations causing fires by violation of this section shall be liable to the State, in an action for debt, to the full amount of all expenses incurred in fighting such fires.

Sec. 19. *Engines in Forest Land.*—Logging locomotives, donkey or threshing engines, railway locomotives and all other engines, boilers and locomotives operated in, through or near forest, brush or grass land, which do not burn oil as fuel, shall be provided with netting or steel or iron wire so constructed as to give the best practicable protection against the escape of fire and sparks from the smokestacks thereof and adequate devices to prevent the escape of fire from ash pans and fire boxes; and failure to comply with these requirements shall be a misdemeanor, punishable upon conviction by a fine of $500; and any officer or employe of a railroad company violating any provision of this section shall be liable to a penalty of $100 for every such violation; and, furthermore, the railroad company or owner of such engines shall be liable in a civil suit for all damage to any property of any kind whatever injured or destroyed by fire caused by such engines, such damages to include detriment to the land and the vegetation thereon.

Sec. 20. *Criminal Action—Forest Trespass.*—Every person who unlawfully and wilfully cuts, injures or destroys any kind of wood or timber or the product of such wood or timber standing or growing upon the lands of another, or of the State or of the United States, or upon any public highway, or carries away any wood or timber or products thereof from such lands, is guilty of a misdemeanor, and, upon conviction, shall be fined not less than $25 nor more than $1,000, or be imprisoned not less than fifteen days nor more than three years, or both, in the discretion of the court.

Sec. 21. *Civil Liability for Forest Trespass.*—In addition to the penalties provided in section 20 for willful trespass on forest lands, the private owners, the United States, the State, or the County upon whose lands the willful trespass was committed may recover in a civil action double the amount of damages suffered; or, in case of involuntary or innocent trespass, or of taking such wood or timber from uncultivated woodland for the repair of a public highway or bridge upon or adjacent to the land, civil action shall lie only for the actual damage, as determined by the value of the wood and timber taken and the detriment to the land.

Sec. 22. *Clearing Along Country*

Roads and Railroads.—Counties, along the county roads, and railroad companies, along their lines of road, in forest or brush land, shall, when so directed by the State Forester, and in a manner and to an extent prescribed by it, cut and remove all brush, grass and inflammable material from their rights of way. If such clearing is not done within a reasonable time after notice, said time to be fixed by the State Forester, the State Forester shall have it done and the County or railroad company shall be liable in an action of debt for the expense thus incurred, and in addition thereto for the expense of any fire patrol rendered necessary by such delay.

Sec. 23. *Disposal of Moneys Received as Penalties.*—All moneys received as penalties for violations of the provisions of this act, less the cost of collection, and not otherwise provided for, shall be held in the State treasury as a fund available only for forest protection; provided, that one-quarter of every fine received, or such portion thereof as shall not exceed $25, shall be paid to the person upon whose information the action was brought, and an equal amount shall be paid to the Fire Warden who made the arrest; and, further, that if a Fire Warden is both informant and prosecutor he shall be entitled to one-half the fine, or as much thereof as shall not exceed $50.

Sec. 24. *Moneys for Forest Purposes.*—County Boards of Supervisors are hereby authorized to appropriate money for purposes of forest protection, improvement and management; provided, however, that such sums shall not in any one year exceed one per cent of the assessed value of the County property.

Sec. 25. *Payment of Expenses Under This Act.*—The sums needed for carrying out the provisions of this act shall be appropriated annually out of any money in the treasury not otherwise appropriated.

Sec. 26. All acts or parts of acts inconsistent with the provisions of this act are hereby repealed.

Sec. 27. This act shall take effect and be in force immediately after its passage.

In addition to the foregoing sections the Bureau is considering others covering the matter of a rebate tax on planted and cut-over lands, and in regard to Arbor Day.

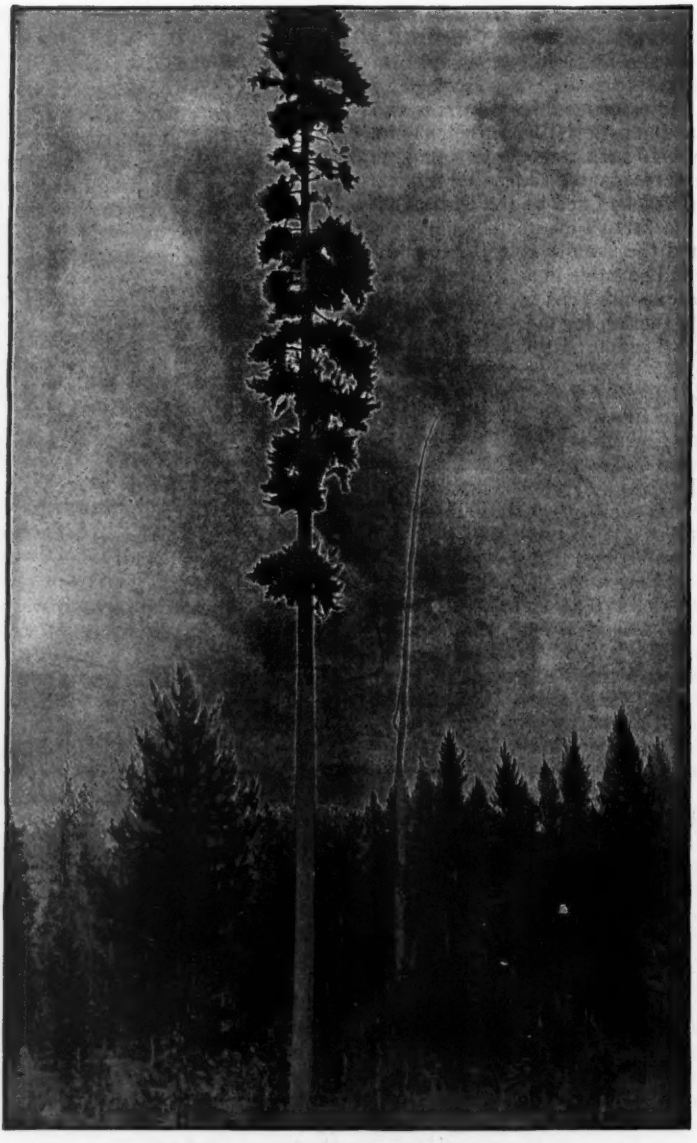
THE FORMATION OF LODGEPOLE PINE FORESTS

BY

MARTIN L. ERICKSON

LODGEPOLE PINE is primarily a gregarious tree. In the Rocky Mountain region the typical Lodgepole pine forest is a pure forest of even stand of nearly the same age. It covers within its altitudinal zone whole mountain sides, to the almost entire exclusion of other species, extending uninterrupted for miles through canons and along mountain divides.

Such pure forests, however, are comparatively young as a consequence of the inevitable forest fires which pass intermittantly through the mountains, destroying the virgin timber. New forests must establish themselves over these burned districts. The mature Lodgepole forest is not always a pure forest. As the tree grows older, the dominant ones suppress and finally kill a great many overtopped trees. This leaves space for more tolerant species, as the Engelmann spruce and



Ordinary Mountain Form of Lodgepole Pine.

Alpine fir, which eventually form the trees in mixture. At the foot of mountain slopes along ravines and creeks, Alpine fir and Engelmann spruce are the predominant species in mixture with lodgepole pine; then as we ascend the mountain, we pass through a broad zone of almost pure lodgepole, extending for two or three thousand feet in elevation; coming out near its upper edge, we meet with red fir on the ridges and rocky slopes; then near the top of the mountains the Alpine pines and Alpine types occur. In general, the statement is true, that wherever lodgepole pine is found the prevailing species is lodgepole.

In the northwest, west of the Rocky Mountains, in Idaho, and Washington, the lodgepole pine was frequently observed to occur in pure stands; but cedar, hemlock, silver pine and bull pine occasionally form a considerable percentage of the stand in mixture. In Wyoming and Colorado, the bull pine and Colorado blue spruce grow with it.

Lodgepole pine is quite intolerant of shade, especially so when young. Very few seedlings of lodgepole pine are found growing in the dense virgin forest. The young plant will not grow under a heavy shade of forest trees. It is only on exposed areas that lodgepole comes up thick and vigorous. When the conditions are most favorable, as on a steep hillside where the light can enter from the sides, and where the soil is firm and of suitable quality, it is then possible for seedlings to come up under the old trees. The young slender trees in the pole forest stage, growing very thickly together, persist tenaciously in the struggle for dominance, even when only the tip of the crown receives light from above. In such cases the top is very short and thin and the tree is a tall, slender pole. The larger trees exist and do fairly well under partial shade, as when growing in rather open forests in mixture with Alpine fir and Engelmann spruce; in the pole forest the overtopped trees succumb to death very slowly. It is the killing off of these inferior trees that make the dry dead and down stuff so common in the pure lodgepole pine forest.

The fact that lodgepole pine does not come up under much shade determines largely the composition of the forest. If much light is required for the growth of seedlings, it means that the forest will either be open in character, consisting of trees of varying ages, or else it will be dense and all the trees of practically the same age. Lodgepole pine forests occur in both of these forms, but the latter is the most typical and common.

Reproduction of lodgepole pine is so closely interwoven with the effects of fire that we might say the prime cause of new stands of lodgepole pine is the result of a burn.

Like the jack pine of the Lake States, the lodgepole pine cones do not open immediately after maturity, but the scales remain closed from two to ten years, or until made to open by heat. During this time, the ripe seed, protected by the cone scales, remains intact and seems to lose none of its vitality. Young seedlings of lodgepole pine spring up very abundantly on burned over districts, and soon clothe the entire ground with a dense cover of reproduction.

A fire passing through a lodgepole forest kills the trees, but unless the fire is severe, leaves the trees standing and the heat of the fire is sufficient to open the cones, but not enough to destroy them. The winged seeds now set free are blown long distances, finally lodging on the ground, and becoming partially covered by the next rain, germinate very readily, and grow up in the open, forming a very dense cover.

Because of its very thin and tender bark, the lodgepole pine is extremely sensitive to fire; a mere ground fire often doing considerable injury to whole forests. A severe ground fire will not only scorch the trunk badly, but will burn deep into the wood, and will either leave a mere shell of trunk, or will completely girdle it, thus entirely killing the tree. Perhaps

there is no species better able to recover itself after a fire than lodgepole pine. Instances of recovery are common where more than half of one side has been burned away. This process of healing begins with the uninjured portion and extends all the way round the stem, and after the tree has nicely started to repair itself, it often seems to grow faster than it did before the fire occurred. The probable reason for this is because of the more light and root space available by the death of many surrounding trees.

Lodgepole pine, on account of its dense growth, thin bark and dry resinous character of the wood, burns more freely than many other species and will prolong and extend a forest fire, whereas if the forest were composed of more fire-resistant species, the opportunity for extending area of a burn would be limited. Burned strips and blocks are frequent in lodgepole pine regions, showing where the susceptible lodgepole has been destroyed, while other species like the red fir have been left intact. In less dense forests of mature trees the lodgepole is able to withstand ravages of fire nearly as well as other pines and spruces; the bark is thicker, the ground is not covered with that mass of dry pole stuff, and the distance between individuals prevents fire from passing from tree to tree.

Types of Young Lodgepole Growth About 20 to 25 Years Old.

The re-seeding of burned areas by spruce, fir, and most pines is effected from seed of border trees or from an occasionally surviving specimen, and not from the destroyed trees themselves, as in the case of lodgepole pine. The tender cones of these species do not protect the seed within, and usu-

ally the cones open and permit the seed to drop to the ground the very autumn they mature. A slight surface fire, then, is sufficient to kill all the seeds and sprouts. The thick-scaled, serotinous cones of the lodgepole pine remain closed under natural conditions for several years. As is usually the case, a surface fire, or often a quite severe fire, does not affect or sufficiently burn the cones to prevent them from carrying the seed through the fire; later the cones open and liberate the seeds, and re-seeding takes place from the standing fire-killed trees more certainly and rapidly than is usual by spruce and fir from living trees. The heat from a surface fire may burn a portion of the trees, and a part, if not the whole, of the top may be heated, but not burned, and the cones begin to open so the seeds are in time set free. Of course, a great many of the seeds reaching the ground fail to germinate, but the quantity shed is so great that a sufficiently thick stand of reproduction is always assured.

As the tree fruits every year, nearly all standing trees are loaded with a crop of cones, the side branches as well as the crown portion producing them. It is easy to imagine the immense quantities of seed from a whole forest when all these cones liberate their seed at practically the same time. It is not surprising then to understand the cause of the dense lodgepole reproduction on burned over areas.

The reappearance of lodgepole pine over burned land, originally occupied by itself, is doubly assured, because reseeding may take place not only from living trees, but also from the standing fire-killed trees. The reproduction of lodgepole is still further ascertained, because of the early fruiting of young trees. Fully mature cones have been found on small trees five to eight feet high, and from ten to fifteen years of age. Lodgepole extends its area beyond the original one a considerable distance on all sides. This continual process of renewing itself on the same ground after burns may go on for generations; trees of different ages, bearing fire scars at different periods, indicating three of four separate crops, are found standing in isolated places overtopping the dense young growth.

From sample acres, on which reproduction studies were made, the number of specimens varies greatly, but it would be safe to say that the average acre of reproduction on a burned over area contains 15,000 specimens. As an illustration of the density of seedlings, on a gentle north slope at an altitude of 6,600 feet in a moderately deep sandy loam soil, a sample acre of lodgepole reproduction gave by actual count 17,968 seedlings. Again, on another acre in a different locality, but soil and situation practically the same, 13,632 individuals were counted. These seedlings were growing in the open, over a burned area, among considerable dead and down wood, which was not completely consumed by fire. The average age was fourteen years, varying from nine to sixteen; the mean height of the seedlings measured three feet. Many of these small trees were beginning to bear cones.

When the leafy canopy overhead is not too dense, and when some light comes in from the sides, reproduction under partial shade may take place. A good example of this was observed in Park County, Montana, where on a steep hillside facing an open meadow on the north, grew some fairly thick patches of reproduction under tall mature pines. A severe fire had passed over this region about twenty-five years since and left only the larger pines. These pines were badly injured by fire, yet continued to grow, and at the time observed the fire scars had almost healed over. When the fire passed over this region, many cones were opened by the heat, and the seeds, liberated, were left on the ground to germinate. The larger trees which survived the fire still continued to furnish some seed, and because of the light from the sides and loose canopy overhead, the seeds started and

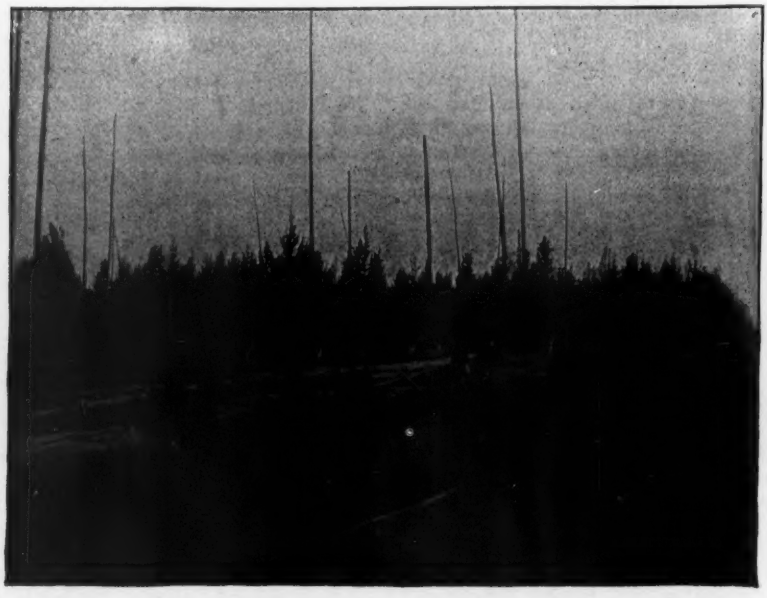
grew. Upon analysis of sample plots the growth was found to be much slower than seedlings grown in the open. The reproduction here was not pure lodgepole, being formed of several species.

From a study of three typical sample acres, the following figures were obtained:

Number of Seedlings and Species on Three Sample Acres—Partial Shade.

Acre No.	Lodgepole,	Englemann spruce.	Dou'l's spruce.	Alpine fir.	Total.
1	5123	327	1462	1198	8111
2	12099	218	2180	763	15269
3	5886	109	4253	—	10248

the stand of poles. The pole forest is very dense. A mature stand is close grown, though not particularly or necessarily dense, as the foliage of the lodgepole is very thin. The density of the old wood diminishes very slowly because of the persistent character of the species. This persistency in growth, and even competition of lodgepole, hinders proper natural thinning, and, consequently, best development of merchantable timber. For these, lodgepole pine patches of pole stuff to become merchantable log size timber is a very slow process, and often requires a hundred years. The trees in the pole forest grow exceedingly close together, and growth is so even all through that the process of thin-



Old Burn in Lodgepole Pine Forest on Lower Slope of Sleeping Cap Mountain. Shows Reproduction of Same Species from Cones on Fire Killed Trees.

The development of "pole patches," resulting in the pole forest, is the direct outcome of reproduction on burned ground. A peculiar fact is noted in regard to the density of mature forests of lodgepole in relation with

ning of less vigorous trees by suppression is very slow. Two to six inch trees, averaging ninety years of age, are common in one of these pole patches. A ninety-year-old tree in the ordinary forest is comparatively large

and usually merchantable from a tie point of view. A tree only four inches in diameter and ninety years old is seriously handicapped in a race where there is no immediate prospect for dominance and growth to merchantable size. Under the best conditions state, for the reason that the most vigorous grow rapidly when once assuming dominance, and, in turn, suppress the weaker trees.

Pole patches are not results of natural occurrences, but, as stated at the beginning of this subject, are the direct results of reproduction on burned over land. The young seedlings, very dense when young, reduce their density very slowly, and by the time the tree has reached pole size, it is still struggling for dominance over its neighbors.

Burn of 1889 on Blackfeet Reservation, Near Midvale, Montana. Densely Restocked with Lodgepole Pine.

of soil and situations these pole patches can develop into good standing timber; if the situation is not suitable, the merchantable stand is poor. Scarcely ever do we see poles growing thick and slow in good soils and situations, and continuing in that

The red fir has much the same power of germinating on burned over areas, and will stand a much greater dryness than lodgepole pine. On steep southern slopes the dry conditions are too intense for lodgepole to maintain itself; the red fir has undisputed possession of the ground. In many localities lodgepole pine and red fir were observed coming up together in equal quantities. The red fir showed a somewhat slower growth than lodgepole, but since it is able to withstand some shade, it maintains itself with ease.

The study of the ecological devolopment in the successive steps to reforesting of denuded and burned over areas is made much easier because of this peculiar, yet fortunate, power of the lodgepole pine to establish itself over such areas. With the ground exposed by fire to the hot summer sun, the soil bakes and cracks, and it hardly seems possible that any except the most zerophytic types of vegetation could exist in such dry situations, but the seed of the lodgepole pine find here a favorable germinating bed, and in a few years after the burn, young

Slopes on Northern Side of Grayback Range, San Bernardino Forest Reserve, California, Bearing Lodgepole Pine and Limber Pine. Altitude 11 000 Feet.

seedlings are well started, and in a decade this ground is completely covered with the young plants from a foot to five feet in height. After the ground becomes well shaded by dense reproduction, and a humus gradually accumulates, the soil loses its hard and dry character, and henceforth in the growth of the young forest, rapidly regains its organic composition from the decay of vegetative mould and pine needles. The intensely dry character of the soil is gradually lessening, and finally when the pole condition of forest is developed, we have that stage in the growth of lodgepole where the fiercest kind of a struggle for dominance and survival results in an almost stationary diameter increase, while the height growth is rapid. The characteristic tree now is one with a long, slender bole, small crown and shallow roots.

Those specimens in the pole forest less able to cope with the strenuous situation must eventually die, or become so weak that decay sets in, or the wind blows them down. The dominant trees continue to grow very rapidly, and soon become merchantable from a tie standpoint. The dead and down stuff, if not burned again, decays and gradually forms a humus, which enriches the soil. The density of the forest becomes very much reduced, forest underbrush grows up, and the soil gains in organic and mineral constituents, and if of a clayey consistency, the water content has increased very perceptibly. Scattered seedlings of lodgepole pine, spruce, and fir now spring up. A deep layer of humus is formed, much moisture is retained in the ground, and if no more fires occur, the forest, by the gradual encroachment of more mesophytic types of vegetation, has again regained its virgin character.

We have now the original mixed forest as it was before the fire occurred.

The ordinary occurrence of lodgepole pine throughout its range in the Rocky Mountain region in even stands and even-aged forests, and a study of the growth and development of the pine forest from the seedling stage to the mature tree, leads to the conclusion that forest fires directly determine this uniform character of lodgepole pine forests.

A fact of mighty importance to irrigation and agriculture in the West in relation to forest covers on mountain sides at sources of streams for the regulation of water supply, is that lodgepole pine does not, under natural conditions, vacate territory when once gaining a foothold, but in spite of repeated fires, quickly re-establishes itself on the same ground and continues to extend its original area.

NEWS OF RECLAMATION SERVICE

Progress of Work of Former Projects and Result of Search for New Ones

Situation in South Dakota.

MR. F. H. NEWELL, Chief Engineer of the Reclamation Service, states that the progress of construction in South Dakota has been delayed by the indifference to or ignorance of the situation on the part of the local land owners. It is necessary before construction can begin to obtain an agreement from the land owners to abide by the conditions of the reclamation law in regard to the subdivision of land and the repayment of the actual cost of irrigation. A number of land owners who would be greatly benefitted are hanging back and jeopardizing the work.

Over one million dollars will be in-

Truckee Valley, Looking East from Point 6 miles West of Wadsworth, Nev.

vested in construction in South Dakota as soon as the land owners take action. The enormous increase of value which will result should be sufficient to attract these men, but many of them think that by holding back they can secure benefits without making payments. In this they will be disappointed, as alternative plans are being considered to build a smaller system, and cut out areas for which the owners have not signed. It is not desired to condemn this land to perpetual sterility by so doing, however, and land owners are being given opportunity to subscribe.

The work consists of a canal taking water from the Bellefourche River, on the north side of the Black Hills, and irrigating the lands on both sides of the stream. It is probable, however, that the original plan will be modified, omitting the south side canal, and planning a smaller canal on the north side, if the land owners delay much longer. If the land is excluded it will probably not be possible to enlarge the works to cover it, as the construction is of a permanent character, and there is strong pressure brought to bear to begin construction at other points in the state as soon as this matter is definitely determined upon.

As construction has already been begun in this locality, it is the intention to give the people every reasonable opportunity, and if this is neglected, to at once reduce the system or transfer the work to another part of the state.

Progress in Oregon.

UNDER direction of Mr. John T. Whistler, engineer in charge of irrigation work in Oregon, exhaustive examinations of alternate schemes in connection with the Umatilla project are being carried on, and work on the Malheur project has been continued along the lines of the development of topography of irrigable lands. Borings with diamond drills have been made and test pits sunk in the vicinity of dam sites.

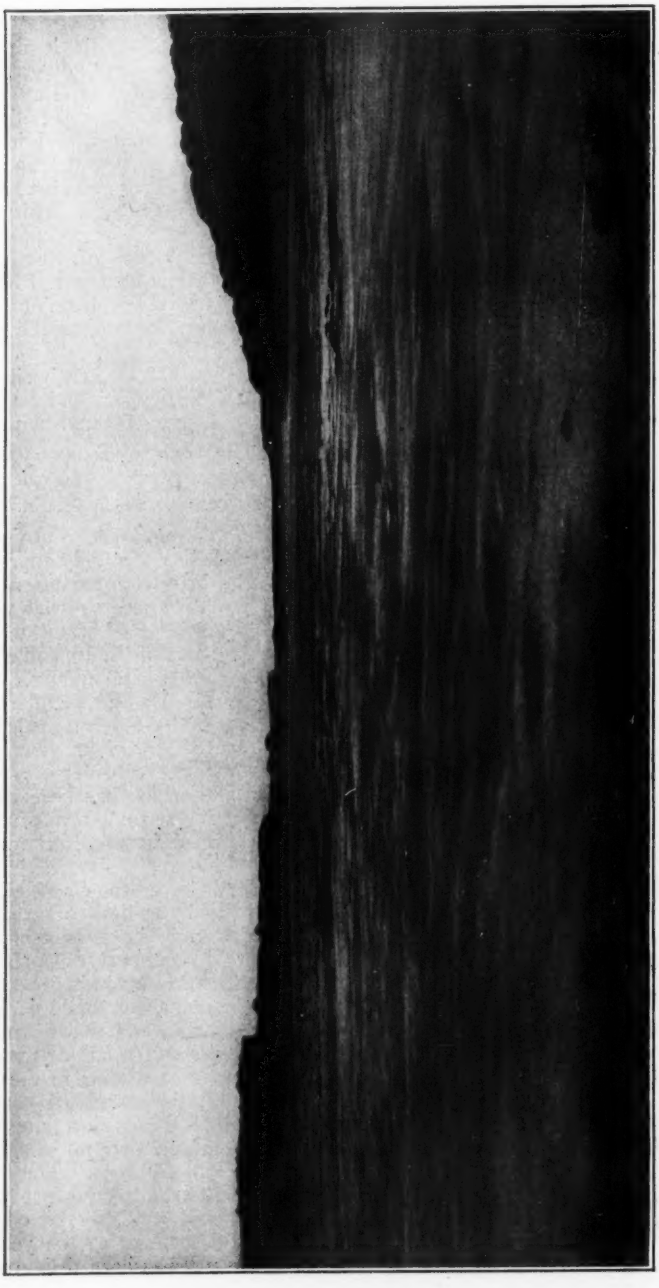
A field party investigated the possibility of diverting the waters of John Day River onto Umatilla lands, and reports that any project to divert water from North Fort of John Day River below the confluence with Bull Run is impracticable, as it would involve the construction of a canal approximately 120 miles long at a cost roughly estimated at $1,600,000. This party will investigate the diversion possibilities at the confluence of North and South Forks below the town of Monument. A diversion at this point would justify a heavy expense, as the minimum discharge is large.

Topographic parties are busily engaged in sinking test pits and mapping various sections connected with the several projects contemplated.

The Truckee-Carson Project.

THE Truckee-Carson project in Nevada has been duly approved, various contracts let for construction, and the work is now so well under way that it is believed water will be delivered to some of the irrigable land in the year 1905. In anticipation of this, careful surveys and examinations of these lands have been made and plates prepared for four townships within which are considerable areas of public land which has been segregated under the second form of withdrawal, specified in the Reclamation Act.

These lands have been classified into farm units and the limit of area per entry which may be reasonably required for the support of a family upon these particular lands fixed. The charges which shall be made per acre upon said entries, and which are apportioned equitably and determined with a view to returning to the reclamation fund the estimated cost of construction of the project, are estimated to be $26 per acre, to be paid in ten annual installments. The time when payments shall commence upon these lands will probably be on the first day of December of the year in which the water has been delivered to



Minidoka Reservoir Site, Idaho.

these lands during the month of April. That is to say, if the works are completed so as to deliver the water in April, 1905, then payments should begin in December, 1905. If, however, through delays, water will not be available until after April, 1905, but is available on or before April, 1906, then payment should begin on December 1, 1906.

It is expected that about 250 farms will be open to homestead entry in the near future, under the terms of the Reclamation Act of June 17, 1902, and at a later date announcement will be made as to the time when applications for water rights for said lands will be received.

The Uncompahgre Project.

THE widespread interest in the various projects of the Reclamation Service is manifest by the deluge of letters addressed to both the main office at Washington, D. C., and the local engineers. So many inquiries concerning the public lands available for settlement under the Uncompahgre Valley reclamation project have been received that the District Engineer has prepared a circular calling the attention of persons who anticipate entering upon such lands to the following facts:

"This project includes parts of Montrose and Delta counties, in Western Colorado, these tracts constituting the Uncompahgre Valley, traversed by the Denver and Rio Grande Railway, and including the towns of Montrose, Olathe, and Delta. It is estimated that approximately 185,000 acres will be covered by the system, of which about 125,000 acres will eventually be irrigated. Of these lands more than 100,000 acres have passed from the control of the Government, so that a comparatively small amount still remains in public ownership. All of the public lands lie along the borders of the tract to be irrigated, and in general it cannot be definitely known what lands are irrigable until the final location of the canal lines has been made and approved.

"All of the public lands referred to are in an arid condition, incapable of cultivation until water is available for their irrigation, and there is no possibility of watering the lands from any other source than from the system proposed by the Government.

"The Secretary of the Interior has directed that as soon as it is practicable all of the public lands shall be divided into homesteads or farm units, but one of which can be entered by a qualified homesteader. In making such subdivisions the engineers will be guided by the character of the soil and the topography, to the end that there shall be included in each homestead as nearly as may be the prescribed amount of irrigable land of average quality, and lying suitable for both irrigation and drainage with reference to the ditches for these purposes.

"The lands have not yet been classified, nor have the exact tracts which will be irrigated been determined, and the charges for water and conditions on which it will be furnished have not yet been definitely fixed.

"The amount of land which one person can take will probably be limited to 40 acres of good land. Occasionally where desirable lands are cut by ridges, arroyos, and rock outcrops, the total entry may be made large enough to include 40 acres of good land. The limit of the homestead entry has not yet been definitely fixed, however.

"The work of construction of the proposed system is at this date but just commenced, and it is not possible that any water can be delivered prior to the crop season of 1908.

"Those who may prefer to purchase lands rather than make homestead entries will find considerable land of good quality under the project owned by private individuals and corporations, which can be purchased at prices varying from $10 to $50 per acre. Parties purchasing such lands should inspect them on the ground, so that they may know what they are buying.

"While it is true that the construc-

tion of the project will furnish work to a considerable number of people, parties contemplating a livelihood in this way are advised to go upon the ground in person and to investigate the conditions before incurring the expense of moving.

"Attention is also called to the circular of a general character, approved by the Secretary of the Interior, under date of March 31, 1904."

The circular referred to may be had upon application to the office of the Geological Survey, Washington, D. C., or to any of the local offices, and applies to all lands withdrawn under the terms of the Reclamation Act.

Owens Valley, California.

THE engineers of the Reclamation Service in California have made varied and thorough examinations of the land and water conditions in Owens Valley, in that State, and the reports to the Chief Engineer seem to indicate that this valley has particular merits to favor it as an advantageous location for an irrigation project. Among these are mentioned an abundance of water power, fertile soil, congenial climate, nearby markets for all agricultural projects in Tonopah and Gold Field, and a possible outlet to Los Angeles in the future.

The total area of the valley is roughly estimated at 280,000 acres, of which 75,000 acres are first-class land, 50,000 acres second-class, 80,000 third-class, and 75,000 acres fourth-class land. First and second-class land is all of value as soon as water is applied. Third-class land will need drainage and washing and will require considerable work to bring into shape, and fourth-class land is too rough for irrigation or is waste from some other cause.

This estimate would seem to indicate that there is more land than water for irrigation, and the problem will therefore be to select the most desirable land. Little difficulty should be experienced in such selection, however,

Making a Road to Cement Plant, Salt River Project.

as the alkali land lies in a more or less continuous body along the lower parts of the valley and will probably be allowed to lie in its present condition, as it furnishes a certain amount of pasturage in salt grass, and its present owners claim that it is quite valuable for winter feed. It is probable that if the irrigation systems are confined to the lands at present holding water rights and to such new lands as are in good condition for irrigation, and which will require a minimum expenditure for drainage, all the land for which there is water can easily be found.

Should the volume of available water exceed the present expectations, all the land susceptible of irrigation that could be supplied would be reclaimed, as the kind and amount of alkali which the land contains would undoubtedly permit of reclamation.

Owens Valley is suffering at present from an over-abundance of water. Thousands of acres are damaged by seepage water, and some system of drainage is as desirable as more extensive irrigation. Large areas of swamps could be drained and rendered fit for cultivation, and the water thus developed on the upper lands would prove available for the irrigation of lands lower down the valley. Should the Long Valley dam site prove a good one, and surveys be ordered, it is probable that a study of the character of these return waters will be made.

Salt River Project.

THE extreme high water in Salt River, caused by the September floods, damaged the Phoenix-Roosevelt road, built in connection with the Salt River irrigation project, to a considerable extent. On long portions of the road, where it was expected no work would have to be done, mud was deposited to a depth of from two to four feet, making it almost impassable. The bed of the channel shifted and a large amount of material was deposited at various points along the river, raising the general surface in places some three or four feet.

Up to October 16 eight tunnels had been completed, with the exception of the lining, and work on the upper portion of the headworks tunnel is progressing favorably, although the extreme care and skill required on this work necessitates great caution.

The engineer in charge of the Salt River project, not being satisfied with the former reports on the sources of salt in the river, directed a party to proceed up the stream to the source of the salt, or until fresh water was reached. A steadily increasing amount of salt was found until the party came to Carrizo Creek. The total amount of salt in the river below the mouth of this creek was 1,650 parts per million. The total amount above was 83 parts, and the salt contents of the creek at the mouth were 9,900 parts.

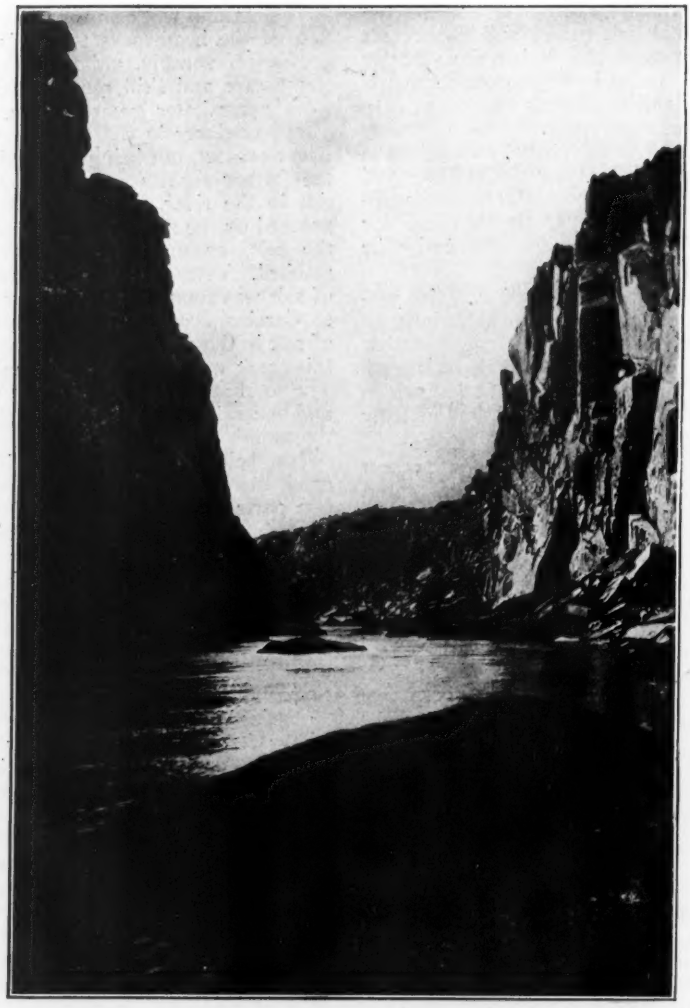
Just below the salt springs in this creek the amount of salt reached 14,000 parts, and just above, 198 parts. A study of the variations of salt in the river from Livingstone to this point shows conclusively that by far the greatest quantity of salt is furnished by this creek. The salt springs extend over a distance of about half a mile, the discharge from them being three to five second-feet.

An investigation will soon be made of the feasibility of controlling these springs, as the value of irrigation in the valley will be enormously increased if it is found possible to control the salt in this river.

The new cement mill was nearly completed during September, and fire brick for lining the cooler portions of the kilns were manufactured. Drilling on the power canal, the construction of buildings and other miscellaneous work is being carried forward rapidly.

Planning for North Dakota Irrigation.

A BOARD of consulting engineers of the United States Reclamation Service, consisting of Arthur P. Davis, George Y. Wisner, C. H. Fitch,



North Platte River Looking Upstream from 200 Yards Below Dam Site of Pathfinder Reservoir, Wyoming.

and W. H. Sanders, recently convened to discuss the possibilities of irrigation in North Dakota.

It has been found that the use of gravity systems, except in the Fort Buford project, is out of the question, and the problems connected with the raising of water by pumping are now engaging the attention of the engineers.

Surveys and investigations by field parties under the direction of Mr. H. A. Storrs have disclosed the fact that bench lands suitable for irrigation by pumping water from the river, exist near Bismarck at elevations of from 25 to 30 feet above the river.

Besides this section some possible locations for pumping plants are believed to exist on the Little Missouri, Mouse, Hart, Knife, and other rivers in North Dakota which will be included in the present investigation.

On many of the proposed projects small streams and washes cut across the irrigable lands and at certain seasons of the year carry large quantities of water. Some of this water could be stored by building low dams, thus lessening the amount of irrigation water that would have to be pumped. It is believed that the coulees and deep gulches which frequently occur might be converted in some cases into canals to conduct water from the river back to the pumping plant, or from a pumping plant at the river bank back to another plant for a higher lift at some distance back from the river bank.

The cost per acre for pumping plants, canal systems, and fuel supply cannot be estimated until the present season's work secures data as to the extent and elevation of benches, size and location of plants, etc., and upon this the feasibility of the project will largely depend.

Land Withdrawals for Milk River Project.

IN compliance with the recommendation of the Acting Director of the Geological Survey, the Secretary of the Interior has temporarily withdrawn from any form of disposition whatever, under the first form of withdrawal authorized by Section 3 of the Act of June 17, 1902, for irrigation works in the State of Montana under the Milk River project, certain public lands in the following townships:

For Chain Lake reservoir site—

T. 33 N., R. 13 E. M. P. M.
T. 34 N., R. 12 E.
T. 34 N., R. 13 E.
T. 35 N., R. 12 E.
T. 36 N., R. 11 E.
T. 36 N., R. 12 E.
T. 37 N., R. 10 E.
T. 37 N., R. 11 E.

For Lonesome Lake reservoir site—

T. 29 N., R. 11 E. M. P. M.
T. 29 N., R. 12 E.
T. 30 N., R. 12 E.
T. 29 N., R. 13 E.

The withdrawal of Lonesome Lake reservoir site is for the Marias subproject, under the Milk River project.

Studying Colorado River.

MR. E. C. MURPHY, general inspector of stream gauging under the United States Geological Survey, has been detailed to make a comprehensive study of all hydrographic data of the Colorado River Basin, with a view to estimating the effect of storage upon the overflow of valleys on the lower river.

He will bring together and arrange for publication all the facts bearing upon the rainfall and run-off of this basin, consulting all the present office records regarding reservoir sites to obtain data which may aid him in making a complete and detailed report.

THE NATIONAL FOREST RESERVES

The Purpose of Their Establishment—How They Have Grown, and the Important Ends They Will Conserve

EXCLUDING the two reserves in Alaska, which cover nearly 5,000,000 acres, there are now in the United States 51 forest reserves, with a combined area of 57,833,974 acres. These reserves are divided among 13 States and Territories of the West. If they redeem arid land only to the extent of their own areas, it would mean 373,337 new farms of 160 acres each—for water is the West's greatest need, and it is now recognized that water conservation is to be the most important service rendered by the reserves. What this would mean in the way of increased agricultural wealth it is easy to see.

The people of the United States, as a whole, have little idea of the enormous magnitude of the interests affected by the Government's forest reserve policy. Timber supply important as this is, is a relatively small part of the whole purpose. The reclamation of millions of acres of arid land, a sustained or heightened fertility for other millions of acres of farm lands, and, finally, the safeguarding for the future of pasturage for millions of head of sheep and cattle are already certain results of that policy. It contemplates furnishing the present and thousands of prospective settlers wood, water, tillable lands, and prosperous homes. Roundly stated, the purpose is to give these forest reserves their highest utility to all who use them now or will use them hereafter.

This is clearly a work of stupendous proportions. Irrigation, which will prove the salvation of millions of acres of these lands, can not realize its largest possibilities unless the watersheds of the West are under conservative forest management. Great damage has been done there by overgrazing, reckless lumbering and, most of all, by fires. Reserves were established to stop this damage and to give the forests their greatest usefulness by conserving the water supply without shutting off the supply of timber. On account of the expense and natural conditions involved, there is a limit to the size of impounding reservoirs, hence the necessity for preventing their overflow by floods, and for making their supply regular, that all the water possible may be saved for use. Forests are the chief agency in this work, and to maintain them is absolutely essential to the reclamation of the arid West.

This use of a forest, however, is not at all inconsistent with its use for many purposes. Lumbering, when rightly done, is an advantage, not a detriment. Grazing, when regulated, does not injure the forest, and prospecting, locating, and developing mines are not interfered with by reserve restrictions. Thus the Government, in establishing reserves, in no sense withdraws the forests from use. On the contrary, while all their present uses are continued, their greatest power for good is kept from injury and increased in value by the wise and careful protection afforded the reserve management. Only under such management can these forests most effectively aid irrigation in reclaiming thousands of square miles of waste lands, and in building homes over vast areas hitherto regarded as impossible of settlement.

The Bureau of Forestry has had during the past summer 15 agents in the field investigating actual and proposed forest reserves. If they discover that agricultural lands, or lands more valuable for other purposes, have been included in reserves, they will recommend their immediate exclusion. If they find land which will be more useful when reserved than

when not reserved, they will recommend that it be added to an adjacent reserve or form a new one.

Often the hardest task of the Bureau agents is in reconciling conflicting local interests. Sheep and cattle men may be disputing over the same grazing grounds, or each class may be at war over individual grazing rights. Again, owners of farms or of water-power plants may object to any grazing in the forests, lest the water supply be injured. In all such cases the Bureau experts must examine and report on every phase of the question, that, so far as possible, absolute justice may be done to all interests. In perfecting present boundaries and increasing reserve areas temporary local injury to some interest is sometimes inevitable. This is most unfortunate, but these occasional injuries can not weigh against the importance of the general purpose of forest reserve establishment.

In all of this work one large fact is to be recognized. It is that in the execution of the policy of reserving from private acquisition such parts of the public domain as are suited to forest growth and most useful under permanent forests, a far-reaching and beneficent policy is being carried out. Under it the government is acting to secure perpetually in the interests of the whole people vast wealth-producing resources which otherwise, under the stimulus of immediate private profits from lumbering, grazing, and the like, would in no long time be lost forever.

A TRIP THROUGH THE SAN BERNARDINO FOREST RESERVE

BY

GEORGE BELLIS

THE San Bernardino Forest Reserve is located in the San Bernardino range of mountains and in San Bernardino County, California. It was established in 1893 largely as the result of the persistent efforts of the late Col. Adolf Wood, manager of the Arrowhead Reservoir Company, and other public spirited men of San Bernardino. It lies in a north and northeasterly direction from the San Bernardino Valley, famed as producing one-third of the orange crop of the entire State, and also noted for its irrigation systems, which are far advanced and nearer perfection here on the whole than at any other place in the United States. Enormous pumping plants, miles of concrete-lined canals, and tunnels through the mountains are very much in evidence throughout the valley. Thousands of dollars are here invested for the maintenance of the present water supply. Costly pumping plants have been installed in some sections of the valley, in all over eight hundred, and money has in no wise been spared to continue, and in hope of increasing the water supply as it was at the beginning of the present dry spell, which has lasted about six years.

Despite all this, water has become scarcer and scarcer, each year since 1898. Some of the big canal companies who are distributing water for domestic purposes do so provided certain economical rules for its use of water are strictly adhered to. One company furnishing water to be used on lawns in Riverside make a special contract for this use of water. It reserves the right to discontinue it without notice should it be deemed necessary, and allows its use before 7 A. M. and after 6 P. M. only, so that the

Wonderful Results from Irrigation as Shown at Redlands, California. Arid Land 15 Years Ago, Now a Most Prosperous Community.

Brookside Avenue, Redlands, California.

lawns might get every benefit possible and the evaporation will be as little as possible.

It can be understood, therefore, that after the great expense incurred in the conveying and saving as much of the water as possible had failed to supply an abundance for all needs, the people of this community are now almost as a whole crying out against the six or seven lumber companies who have in the meantime been denuding the watershed from which the water is obtained.

When the creation of the reserve was first agitated, comparatively few thought enough of it to give the matter serious thought, while others openly opposed it as a scheme of big lumbering interests to get the government to protect certain timber for their special benefit. The writer met a few who are a little "sore" about the matter even now, but in every case he was able to trace it to some personal prejudice.

In my trip through the reserve, I found all the forest rangers in the active performance of their duties. They were uniformed in corduroy trousers, blue flannel shorts, gray hats, canvas leggings, and blue fatigue coats, and carrying a brush, knife, and either a shovel or a rope, and sometimes both. I found also that at certain convenient intervals throughout the reserve were kept fire fighting tools and cooking utensils for the use of volunteers or extra men should their services be necessary.

The uniform of the reserve patrol force is the result of the wide-awakeness and personal observation of the superintendent, Mr. E. B. Thomas, and it impresed the writer as a very excellent plan and one that should be adopted in all the reserves. It gives the visitor to the reserve the impression that the rangers are there for a particular purpose and are not merely residents of the mountains, who draw a salary for wearing a badge and get a "rake-off" from their friends for special privileges. It increases the dignity of the ranger's position, and at the same time does not work a hardship in the way of an extra expense, as the uniform selected by Mr. Thomas is not only very serviceable but also quite inexpensive. Another advantage of the uniform is to make the ranger where inclined to be at all careless about his duty, more careful, as the uniform is readily recognized at a distance, while one would have to be quite close to a ranger to recognize him by his badge alone. So that should a ranger be inclined to shirk his duty at a fire or in the patrol of his district, he will be more attentive to duty if he is uniformed.

Having just completed a trip through the San Bernardino Valley and having in mind the rapid and rather alarming shrinkage of the artesian belt and the gradual decrease of the water supply in the last few years and remembering that the reserve furnishes the only watershed from which the valley obtains its supply, I paid special attention to the ground cover, as there is practically no timber on the southern exposures. I found the south slopes of the mountains below the 3,500 feet level covered by a growth of chapparral, composed of chemise and scrub oak. Where the chapparral had escaped fire it was found to be quite thick and affording a good ground cover. In some of the canons on the southern exposures there are a few big cone spruce that seem to be doing well. It occurred to the writer that it might be of adtage to do something to increase this small stand, and aid nature a little. If these trees grow here naturally under present adverse conditions, they might thrive under better ones. They are, it would seem to the writer, of more value, too, than the knob cone pine (*Pinus attenuata*), because they are of commercial value as well as a good ground cover. There are indications of spruce of considerable size having been cut from some of the canons. These were probably cut for wood, being nearest the valley.

There is no indication of any other timber ever having existed on the

southern exposure below the 3,500 feet level. About this altitude there is found in places the knob cone pine, though not in great numbers or of large size. In the area visited by fire last December the writer found the trees completely killed. Especial attention was paid to the ground conditions in order to find some indications of the seed starting, but without success. Of the fire area, where the chapparral grew, was found an abundance of young growth as the result of coppice. The scrub oak was especially noticeable, as affording considerable cover, to the black, dry ground. This would go to recommend the chapparral as a ground cover on southern slopes, where it is impossible to grow timber of commercial value. It covers the ground much better than the knob cone pine and will grow on steep slopes where pines will not. It is much more resistent to fire and will send up coppice to cover the ground soon after the fire.

Near the crest the cutter pine is found and in some few places where uncut a fairly good stand is observed.

At Fredalba at an altitude of 5,600 feet a good stand of Jeffrey pine is seen where uncut. At this place the mill of Brookings Lumber and Box Company is located, with a capacity of 60,000 feet per day. The Brookings Company own about 650 acres of what was until cut the best timber land in the reserve. Of their holdings about 5,000 acres have been cut over. The slogan of the Brookings Company seems to be, "Get lumber, all of it, and quick." The result is that when they leave, the forest is denuded. They are cutting everything that will make a 2x4 and are leaving all brush where it falls. About 2,500 acres of their property was visited by fire, which originated from one of their donkey engines, and the result is that this much of their holdings is entirely bare. The fire also spread to the adjoining government land, burning over about 1,500 acres of it, making a total area of 4,000 acres. The long haul to the valley below, and the small demand for wood as fuel, make it unprofitable to utilize the tops for cord wood, and as a result all this is left to make a big hot fire when it is once started by a spark.

The area visited by the fire last December is still entirely bare. There is a movement on foot at San Bernardino which has as its object the purchase of the holdings of the Brookings Company in order that the remainder of the timber owned by them may be saved, or at least cut by systematic methods, thus preserving the young growth and some of the mature trees for seeding. The writer is of the opinion that this would be an excellent plan. There is undoubtedly a good deal of timber on the Brookings property that could be cut without serious damage to the watershed, should conservative forest methods be strictly adhered to. Tyler Brothers and later Mr. James Fleming cut considerable timber in the reserve. These gentlemen cut for constructive purposes only and took nothing that would not scale two feet at the butt. They used oxen and horses in logging and as a result the young growth was not broken by having logs dragged over them by donkey engines. The Brookings Company are cutting to make boxes, and practically everything is cut, and what is not cut is either broken down in logging or else consumed by the fire that is fed by the limb stuff and brush left after cutting. If this denuding is allowed to go on as at present, it will be but a short time before there will be no timber left to condense the many fogs that pass over the mountains, and which are condensed and precipitated by the cool forest when the stand is heavy. The timber is confined to the northern slopes of the southernmost ridges, and consists of Jeffrey pine, cedar, and fir, underneath which is a fairly good stand of young growth, among which is dogwood. Especially is this true in and around Little Bear Valley, where the Arrowhead Reservoir Company is building a dam and a series of tunnels, through which

they are to convey the water to the south side of the mountains, and thence through the canals and flumes to the valley. Several electric plants are also to be installed, where the drop into the valley is made. Another very discouraging thing is the way in which the lumberman totally disregards the interests of the reserve. For instance, the San Bernardino Lumber and Box Company recently burned over between five and seven acres on which to pile 500,000 feet of lumber. It is only fair to say that the other lumbermen are not quite as bad in this respect as the Brookings and San Bernardino Company.

While the timber is for the most part on the northern slopes, it certainly should be saved if possible at any cost, as the use of the water from this shed is demonstrated by the Arrowhead Company in their turning it back to the valley, and other projects would certainly spring up should enough water be available.

There are about 2,500 head of cattle being pastured in the reserve at this time, but this is not thought to be doing any harm, as the permits are issued by the Department of the Interior on the recommendation of the supervisor. Approximately 15,000 campers visited the San Bernardino reserve from June to October of last year, and the record of only one severe fire speaks volumes for the ranger service. The number of small fires has of course increased very materially with the campers in the last few years, but they have been quickly controlled by the rangers, who are twelve in number, under the immediate charge of first-class ranger, N. O. Torstenson.

IRRIGATION IN HUMID REGIONS

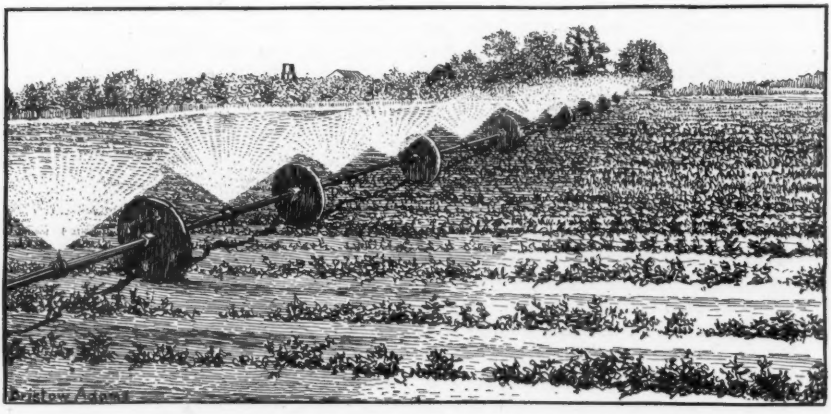
The Practice Extending to the East and South Where the Artificial Application of Water to Crops Brings Splendid Returns

THE advantages of irrigation in the humid climates, merely as a supplement to rainfall in ordinary or extra dry seasons, are forcibly presented in Bulletin No. 148 of the Office of Experiment Stations recently issued by the U. S. Department of Agriculture. The reports of a number of irrigation plants in the vicinities of eastern cities go far to show that as population increases and land becomes more valuable, the zone in which irrigation can be profitably employed will be more extended, as it has been in Europe, where farmers have found that there are few sections where irrigation will not pay simply as an insurance against drought.

The bulletin states that a grower of berries in the vicinity of Poughkeepsie, N. Y., has found that artificial watering guarantees a perfect stand and rapid growth of newly set plants, the highest quality of product, and maximum crops. Owing to dry weather and high temperature during the season of 1903 his berries had colored and hardened but did not sweeten. The application of 10,000 gallons of water in a fine spray and 25,000 gallons between the rows put the berries in fine condition for picking. He also found that to irrigate after applying chemical fertilizers dissolves and distributes the plant food and lessens the danger of injury to plants.

To water market gardens near New York City, on Long Island, and in New Jersey, small plants consisting of pumps, storage tanks, and piping are used with such success that their

owners claim large returns on the money invested. One man stated that he would not attempt to garden for profit without such an assurance of plenty of water when needed. Some loss. Within the last year or two the plan of sinking 1½ to 2-inch wells has been tried and its success is leading to their extended use. A good 2-inch well will furnish water for half a sec-



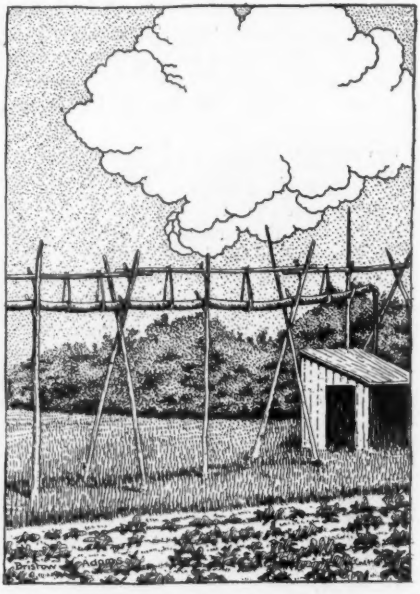
Movable Sprinklers on the Farm of David Astle, Vineland, N. J.

gardeners buy water from city supplies and find it more satisfactory than to install their own pumping plants.

Descriptions of pumping plants of various sizes and styles with their storage basins and distributing pipes are given in this bulletin so that those intending to try artificial watering may profit by the experience of several successful irrigators.

Striking testimony in favor of irrigation is furnished by the careful comparison of crops from irrigated and unirrigated plats of strawberries, asparagus, nursery stock, and onions at the Missouri Agricultural Experiment Station. Not only were yields larger, but in the case of asparagus unirrigated rows were affected with rust while the irrigated plants were entirely free from the disease.

A portion of South Dakota which is noticeably benefited by a supplementary water supply in the James River Valley. In the first attempts to utilize this supply of underground water wells were made so large that the excessive cost resulted in financial



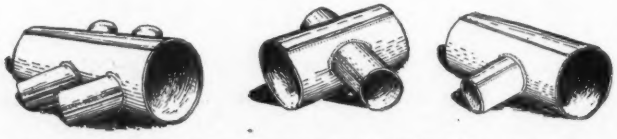
Canvas Hose Supported on Poles from Gasoline Engine Pumping Station.

Distributing Water from a 12-Inch Canvas Hose, Stevens Point, Wis.

Courtesy U. S. Geological Survey.

tion of land. An oversupply of water in the first experiments produced conditions that prejudiced many farmers against the practice, but later tests show that no injury need be feared where water is properly used. All cases of deterioration are directly traceable to an oversupply of water. An excessive amount of water in the soil will smother the rootlets and on evaporation will leave a deposit of salt, so that care must be taken that the soil does not become too wet.

The bulletin as a whole shows the great advantage of irrigation as a means of increasing production and as an insurance against drought, even where the expense of securing a water supply is great.



Forms of Galvanized Iron Laterals for Use With Oiled Duck Hose.

Education in Forestry in England

BY

W. R. FISHER

ALL considerable European countries, except perhaps Portugal, have forest schools. In France there is the National Forest School, founded at Nancy in 1826, where, besides the candidates for employment in the State forests, about 350 other students of all nationalities, but chiefly Roumanian, English, and Belgian, have been taught since 1830. There is in France also a school for forest guards and foresters at Barres, in the Department de Loiret, and the best students from this school can rise to the position of forest officers, and may attain the grade of Inspecteur des Eaux et Forets, corresponding to our Deputy Surveyors of the Crown Forests, though they cannot, on account of their superior age to that of the Nancy students, become Conservateurs, a rank which is not usually attained even by the Nancy men until they have been in the service for about thirty-five years. There are numerous schools of forestry in Germany, the principal ones being Eberswalde, Munich, Thrandt, Tubingen, Giessen, etc. There are several forest schools in Austria, also in Norway and Sweden, one each for Russia, Italy, Switzerland. Holland (chiefly for the Dutch Colonies), Spain, and Belgium. The Japanese have a forest school at Tokio, there are several in the United States, one in India, and one in Burma.

When we consider the extent of the British Empire, and the large area of forests in the British Colonies, it is evident that the establishment of forest schools is necessary in Canada, Australia, New Zealand, South Africa, and Ceylon. Much more has been done for forestry in India and in our Crown Colonies than in the larger, self-governing Colonies, except in the Cape of Good Hope, where there has been a scientific Forest Department for the last thirty years. There are Forestry Departments, under trained

officers, in Ceylon, the Transvaal, Uganda, Mauritius, the Soudan, and the Straits Settlements, and the West Indian forests have been inspected officially by an Indian forest officer with a view of establishing a forestry department. What is now wanted for the Empire is the establishment of a Forest School in Britain, which will train the higher forest officers for India and the Colonies, and instructors in forestry for the larger Colonies, where superior and inferior schools of forestry, on the model of Nancy and Barres, must soon be established. For service at home, the future higher officials of the Crown forests will require thorough instruction in forestry, and also the instructors in forestry at the Agricultural Colleges, at Edinburgh, and at the school for woodmen established at the Forest of Dean, another of which class is proposed for Alice Holt Wood. Such a school will also afford instruction in forestry to the sons of our landowners and to men preparing at our Universities for the posts of land agents to large estates.

I propose here to give a short account(chiefly taken from Ribbentrop's Forestry in British India) of the instruction adopted for our Indian forest officials, who have hitherto formed the principal corps of trained foresters in the British Empire, and to discuss the advisability of now extending this instruction so as to include all the classes mentioned above, whose services are required to make forestry a serious pursuit throughout the Empire.

The necessity for establishing a Forestry Department in India was first realized in 1806, when Captain Watson was appointed Conservator of Forests in Malabar, chiefly to protect the growth of teak and other timbers for the Navy, but a reaction ensued in 1823, owing to complaints of the traders, and the conservatorship was abolished. Great ravages were then allowed in the State forests, and it was not till 1842 that Mr. Conolly commenced the plantation of the famous Nilambur teak plantation, and in 1847, Dr. Gibson, a botanist of note, was appointed Conservator of Forests, in Bombay, and in 1856 Dr. Cleghorn, Conservator of Forests in Madras. In 1852, Pegu, with its splendid teak forests, was annexed, and Dr. McClelland appointed superintendent of these forests, but a permanent policy for the forest administration of India was first laid down by Lord Dalhousie in 1855, Dr. Dietrich Brandis, brother-in-law of General Havelock, being appointed superintendent of the Pegu forests in 1856, and the forests of Tennasserim and Martaban being added to his charge in 1857.

Dr. Brandis then introduced those principles of enumeration and organization, to the working of the forests, that form the basis of our present working plans, and created a practical system of working the Burmese forests of teak, with due consideration to the perpetuation of the trees by natural and artificial regeneration.

His conservative policy interfered with the gains of timber merchants, who were very powerful in Rangoon, and they prevailed so far on the Government of India that orders were issued to open all the Pegu forests to private enterprise, but the selection of the trees to be felled was left to the control of the Forest Department. Fortunately the Tharawaddy forests were still worked under complete departmental control, and after a few years' experience the state lost about £1,000,000 in the open forests, whilst the Tharawaddy forests produced a large regular income. Canadian timber merchants still form the greatest obstacle to scientific forestry in the Dominion of Canada.

Dr. Brandis had gained the day against the timber traders, and in 1862 was appointed Inspector-General of Forests for the Government of India.

Up to this time, officers were appointed to the Indian Forest Service without any special training, but Dr. Brandis came home in 1866 and induced Lord Salisbury, who was then Secretary of State for India, to ap-

point trained men for the service. Dr. Schlich and Mr. Ribbentrop, who were trained in Germany, were then sent out to India, and these officers, both of whom eventually became Inspector-General of Forests, greatly assisted Dr. Brandis in his work of establishing a scientific Department of Forestry in India. At the same time, eight candidates were appointed by the Secretary of State for India to undergo training in France and Germany, and these men went to India in 1869. Another batch of trained forest officers went out in 1871, and the Continental training was continued in Germany till 1875, and in France till 1886. Dr. Brandis was deputed to Madras, in 1881, to reorganize the forest service in that Presidency, and retired from the service in 1882, becoming Sir Dietrich Brandis, K.C.I.E., and was also appointed a Fellow of the Royal Society, and now, in his eightieth year, he is still working at Kew at a comprehensive manual of the Indian forest flora.

Dr. Schlich, who succeeded Sir D. Brandis as Inspector-General of Forests, was deputed home in 1885, to inaugurate a course of instruction in forestry, at the Royal Indian Engineering College, Cooper's Hill, a place admirably suited, owing to its proximity to the Windsor Forest (14,000 acres), to the beech woodlands in the Chiltern Hills, and to the coppices-with-standards in Surrey and Sussex, and to Kew Gardens, for instruction in forestry and botany.

The course of instruction at Cooper's Hill comprises drawing, surveying, road-making and building, accounts and German, elementary chemistry, and the chemistry of soils and physics, entomology, botany, geology (including that of India), and forestry. Thoroughly practical instruction in forest nursery work, and in planting operations, have been given, and the students have also been taught methods of natural regeneration of forests and thinnings in the Chiltern Hills, and in the fine French forests. Besides this, they have spent nine months every year in the Prussian forests, where they are placed only two together, under specially-selected forest officers, so as to learn the practical management of large areas of forests.

Cooper's Hill College is now to be closed, as the Secretary of State hopes to recruit the Indian engineers from the various engineering colleges in Britain, coupled with experience gained in one year's practical work with some engineering firm. Fresh arrangements have, therefore, to be made for the instruction of our Indian forest students, and this it is probably intended to secure at one of our Universities. It is no longer necessary to have recourse to the Continental forest schools, for the following reasons:—

Since 1886, when training our men at Nancy was abolished, considerable progress has been made in forestry in Britain. Dr. Schlich, who, besides possessing a thorough knowledge of theoretical forestry, has managed a woodland of 3,000 acres in the Ardennes for the last ten years, and also more recently the 8,000 acres of the Duke of Bedford's woods, is a good, practical forester. No one can be better qualified for starting a superior forest school for British and Colonial forestry, the necessity for which I have already explained. Continental forest schools do not, as a rule, take a wide view of forestry. Each State in Germany has its own system of management, which is not always applicable to other countries, thus neither the clear-cutting system, practiced in Saxony and elsewhere, nor the compartment shelter-wood system, are generally applicable to India, where the selection system and the system of coppice-with-standards prevail, and where it is hoped to introduce the group system, which at present is carried on only in the Grand Duchy of Baden, in Europe. It is also necessary that our Indian forest students should have some notions of tropical and sub-tropical forestry, and should know something of Indian history, In-

dian law, and land management, which they will not acquire at a Continental forest school. A succession of experienced Indian forest officers, who have been trained by Dr. Schlich and myself, will be available eventually to succeed us as instructors in forestry, while their services would not be available at a Continental school.

Forest management has also made progress in Britain during the last twenty-five years. The woodlands of the Duke of Bedford are now managed according to a continuous working-plan, so are the High Meadows Woods attached to the Forest of Dean, the working-plan for these having been prepared by my lamented friend, Mr. H. C. Hill, who was for some time Inspector-General of Forests in India. Lord Selborne's woods, near Woolmer Forest, are managed according to a working-plan prepared by Dr. Nisbet. Mr. Munro Ferguson's woods in Fifeshire, the Alice Holt Woods attached to the New Forest, are also under working-plans. The magnificent forests of France and Germany have been placed at our disposal by the friendly Governments of France and Germany for our students to learn the management of forests on a large scale.

Sir W. Thyselton Dyer, in giving evidence before the late Committee appointed by the Secretary of State for India, to arrange the future teaching of the Cooper's Hill students, said that one of the most difficult duties that fell to him, as official adviser to the Colonial Office, was the selection of forest officers for the Colonies, and that under present circumstances he could not find properly trained British candidates for such posts. Surely we no longer wish for Colonial forestry appointments to be held by foreigners, and the only way to avoid this in future, as well as to afford the best training for our Indian forest officials, and to keep up a high standard of forest training for our landowners, land agents, and for future instructors of forestry throughout the Empire, is to take the present opportunpire, is to take the present opportunity of establishing an Imperial Forest School at one of our Universities.

Studying the Kootenai River

Government Looking for Reclamation Projects in this Section of the Country

MR. W. W. SCHLECHT, Assistant Engineer of the Reclamation Service, recently made a reconnaissance trip along the Kootenai River between Crossport, Idaho, and Nelson, B. C., in order to determine the practicability of reclaiming about 30,000 acres of land between Crossport and the International boundary line, which are flooded during the high stage of the Kootenai River. This high water stage usually lasts until the latter part of June, at which time the season is too far advanced to raise any of the indigenous fruits and vegetables, and only wild grass for hay can be raised.

At Crossport and above this point the stream is torrential and the banks are high and precipitous, but below Crossport it is sluggish and meanders through a valley averaging two miles in width. Mr. Schlecht reports that this valley is a typical flood plain, the banks being from 5 to 15 feet higher than the major part of the land lying farther back, but they are crevassed in many places and are very pervious, thus giving the water during the high stages of the river free access to the lower land.

Between Crossport and Kootenai Lake there is but one large tributary, which empties into the river in Can-

ada, but there are at least twelve small tributaries, which discharge considerable water during the high stages of the Kootenai. Considering the pervious nature of the soil and the numerous streams which would also have to be dyked, it is not believed that dyking the banks is feasible or practicable.

The fall of the river between Bonners' Ferry and Lake Kootenai is not over 10 feet, while the difference in elevation of Lake Kootenai between high and low stages is at least 25 feet. therefore enlarging or straightening the channel of the river would not improve matters, because it is considered that the stage of the lake is the chief controlling factor governing the stage of the river. As Kootenai Lake has an area of at least 40 square miles and rises 25 feet each year in spite of the fact that it has a continuous outflow, a storage reservoir above Bonners' Ferry would have to hold at least 500,000 acre-feet in order to reduce the high stage of the lake 10 or 15 feet, and a reservoir of this capacity would probably flood as much land as it is intended to reclaim.

There are two other possible ways of relieving this valley of its excess of water, but in both cases the regulating would have to be done in Canada. There are between 20,000 and 30,000 acres of land in Canada north of Porthill, Idaho, which would also be reclaimed. One plan is to divert the excess water through a canal into the Columbia, providing the lands along the latter river would not be damaged thereby, and the other is to enlarge the outlet of Lake Kootenai below Nelson. Further investigation in Canada, however, would be necessary in order to determine the practicability of these schemes. While it will be necessary in some way to lower the water in the lake from 12 to 15 feet, yet some controlling structure would probably have to be put in below Nelson in order to prevent the lake from falling to a stage which would hinder navigation.

Forest Fires

Record of Fires During the Month of October

Damage in any considerable amount from forest fires during the month just past has been principally confined to Montana, although California has suffered some loss. Soaking rains have effectually quenched the disastrous fires in Oregon and Washington, which have done immense damage for over a month. Several small fires are reported in Eastern States, owing to an unusually dry autumnal season.

Montana: A change of wind fanned a smouldering blaze in Warm Springs Canon into life and swept it in a destructive pathway toward the Twin Lakes country. This occurred about the middle of September, and at about the same time as another blaze west of Aanconda, which traveled eastward along the mountain side. Despite a rainfall which extinguished most of the fires in the Bitter Root Forest Reserve mentioned in the last number of FORESTRY AND IRRIGATION, on September 29 a forest first was reported as inflicting damage; in one case burning clear a strip of land ten miles long and a quarter of a mile wide in one night. Game was driven from the forests, and in many cases burned, in forest fires in the Clearwater country, and the Lo Lo district has suffered similarly.

California: Near Rainbow, on Eddy Mountain, a forest fire which started on September 22 was checked in its northernly course by Wagon Creek after consuming several acres of valuable timber land. Power plants and much valuable timber land was threat-

Burnt White Pine Forest, Priest River Forest Reserve in Idaho. Destruction Total.

ened by a large fire in Cajon Pass, which was started by a careless smoker and fanned into destructiveness by a fierce wind. A loss estimated at over $5,000 was entailed by the loss of the Governmental Forestry Experiment Station in Santa Monica Canon. This same fire was the cause of considerable apprehension to the residents of Santa Monica, owing to its close proximity, and some outlying property was laid waste. In Butte County, near Stirling City, a forest fire did considerable damage over an area of timberland owned by the Diamond Match Company. In the vicinity of Escondido, flames swept up Aliso Canon and raged in the hills south of Bernardo.

Oregon: Timber men who have visited Columbia County, report that the forest fires which have been devastating that section for the last six weeks have caused the destruction of timber worth $8,000,000. Very little damage has been done by the fire during the last thirty days, a much-needed rain having extinguished those still burning. On October 4 a forest fire in Grant's Pass was reported to have gained headway, but it is not thought to be of serious consequence.

New Jersey: A forest fire broke out in the heavy pine timber belt between May's Landing and English Creek on October 11, and a blaze of considerable magnitude was reported on October 29, in the Blue Ridge Mountains, 20 miles east of Wind Gap. Newspapers state that the latter fire burned over 10,000 acres.

Georgia: An area of about two hundred acres was laid waste by a forest fire just beyond Kinder Lou, which started from an engine spark.

West Virginia: The long-continued drought in this State has rendered woodland very inflammable, and on October 18 a forest fire not over a mile from Parkersburg caused considerable apprehension to residents.

Pennsylvania: An engine spark ignited the grass and undergrowth in bottom land near Newcastle Junction on October 3 and inflicted minor damage to timber.

Washington: Small fires in Pierce, Pacific, and Thurston counties are reported. In the last named it is claimed that the blaze was started by a man who set a fire without a permit, and was fined for the offense.

Reclamation Survey of Nebraska

A Study of its Water and Land Resources by the Government Engineers

A RECONNAISSANCE survey on the Niobrara and Snake rivers in Nebraska was recently made by Mr. J. C. Stevens, Assistant Engineer in the U. S. Reclamation Service, the purpose of the survey being to determine approximately the fall of these rivers, obtain gaugings of the rivers at frequent intervals, and of their principal tributaries, and to note and examine any reclamation project which might present itself.

The country traversed embraced the lands lying contiguous to the Niobrara River between the 24th and 45th range lines, in townships 30 to 34, inclusive, and the lands contiguous to the Snake River in townships 31 and 32, range 30, and township 30 in ranges 31 and 32, also a territory known as the Lake Country, in townships 30, 31, 32, 33, and 34, ranges 23, 24, 25, 26, and 27, covering a total distance of 351.6 miles.

NIOBRARA RIVER.

The drainage area of this river consists largely of sand hills, resulting in a marked constancy in the flow of

this stream and its tributaries. These sand hills cover the larger part of ten counties, and are of little value except as range land, ten or fifteen acres being required to pasture one cow. Here and there are found valleys, or "hay-flats," usually running east and west, on which are cut quantities of wild hay. The soil is not susceptible of cultivation, because as soon as it is broken it begins to blow. The "sand blows" often cover several acres from which the sand is frequently blown out to a depth of twenty feet. Throughout the entire length of the river these sand hills are the characteristic feature of its drainage areas, sometimes bordering on the very banks of the stream, and sometimes receding several miles, between which and the river there is found a strip of rolling land of firm soil, and susceptible of a high degree of cultivation. However, the rainfall is insufficient to insure good crops, and the lands are too rolling to admit of practical irrigation, even if it were possible to get water on the land. On the upper Niobrara these areas of tillable land are of very great extent on the north side of the river, beginning several miles back.

The Niobrara River almost throughout its entire length runs in a deep canon from 20 to 400 feet deep. This canon has undoubtedly been cut by the river itself through the magnesia or "chalk rock" strata, which are very characteristic of this part of the country, making a firm, fertile soil, where it has not been encroached upon by the sand hills.

IRRIGABLE LANDS.

The only lands within the limits of this survey susceptible of practical irrigation are found in narrow strips along the banks in the bottom of its canons, and are seldom found in tracts exceeding 100 acres. The problem of irrigation here is a very simple one, but there is a lack of irrigation except on the upper Niobrara, where a number of ditches are in successful operation. Boiling Springs, Conly, and Missouri Flats, the only level lands outside the canon, contain a combined area of about 15,000 acres, but they are so high above the bed of the river that gravity irrigation from that source is out of the question.

Aside from a limited number of irrigation ditches on the upper Niobrara and a few small mills, this river is put to no practical use whatever.

SNAKE RIVER.

This river is a tributary of the Niobrara and is in nearly all respects its counterpart. The canon near its mouth is about 350 feet deep, having been cut by the stream through magnesia or chalk formations, characteristic of the country. In Sec.4, T.31, R.30, are found a series of falls from 5 to 14 feet high, above which the water surface is about 50 feet below the surrounding country. There are no irrigable lands contiguous to the lower Snake; nothing but sand hills, so that its development in this connection is out of the question. Power could be developed at little expense if it could be utilized.

THE LAKE COUNTRY.

This territory embraces a strip of country some 10 or 15 miles on both sides of the seventh standard parallel in Cherry County, and may be considered simply as a series of hay flats whose bottoms are below the general water table of the country. These "lakes" are said to have periodic rises, and a gauge was established on Red Deer Lake in order to determine the extent of these fluctuations.

Beyond the territory covered by this survey, that is, east of the 25th range line, through Rock and Brown counties, are found large areas of level, irrigable land. This land is so high above the river bed that water could only be put on it with difficulty, but there is an abundant water supply and irrigable areas to the extent of probably 500 square miles, and it is possible that a reconnaissance survey would develop some probable project for irrigating this land.

Foresters and Inspectors Wanted for the Philippine Forestry Bureau

The salaries of Foresters, Assistant Foresters Inspectors, and Assistant Inspectors range from $1,200 to $2,400 per year. Actual and necessary traveling expenses to and from the scene of field work are allowed, and while in the field one dollar gold per day is allowed for subsistence.

There are a number of vacancies in the different grades, and good men are urgently needed for this interesting and important work.

The work of the Foresters is, to a large extent, technical; that of the Inspectors more administrative and less technical.

Examinations will be held in different parts of the United States about July 1 and November 1. For detailed information apply to the Bureau of Forestry, Washingtou, D. C., or to the Bureau of Insular Affairs, War Department Washington, D. C.

Foresters and Inspectors now in the Philippine forest service and having from two to three and a half years' service, find the work very attractive, instructive and healthful.

Copies of the Philippine Civil Service Manual may be obtained from the Bureau of Insular Affairs, War Department, Washington, D. C.

The reports, bulletins and other applicat ons of the Philippine Forestry Bureau should be read by all desiring to enter the service. Copies may be obtained by addressin the Forestry Bureau, Manila, P. I.

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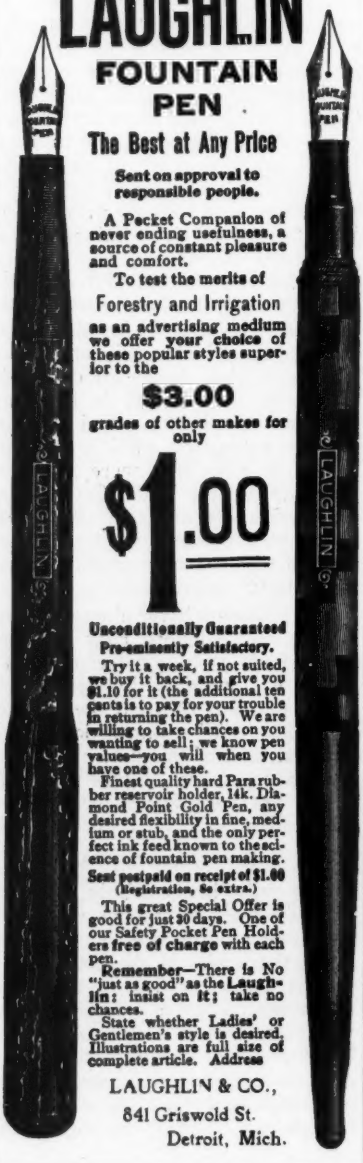

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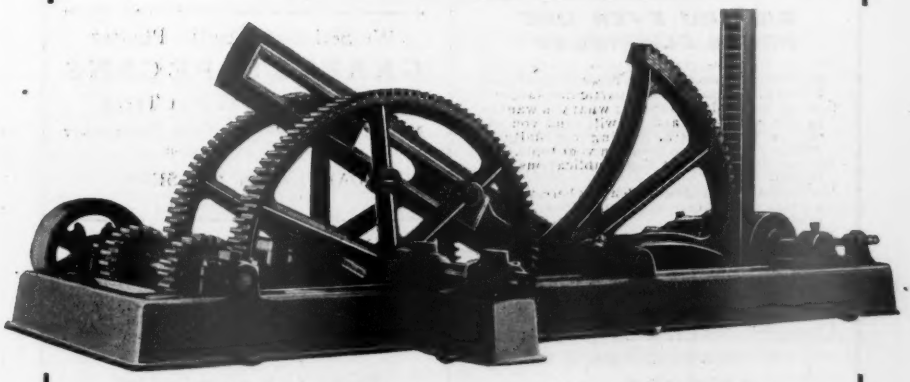

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2. The preservation and development of our national resources by the construction of storage reservoirs by the Federal Government for flood protection, and to save for use in aid of navigation and irrigation the flood waters which now run to waste and cause overflow and destruction.

3. The construction by the Federal Government of storage reservoirs and irrigation works wherever necessary to furnish water for the reclamation and settlement of the arid public lands.

4. The preservation of the forests and reforestation of denuded forest areas as sources of water supply, the conservation of existing supplies by approved methods of irrigation and distribution, and the increase of the water resources of the arid region by the investigation and development of underground supplies.

5. The adoption of a harmonious system of irrigation laws in all the arid and semi-arid states and territories under which the right to the use of water for irrigation shall vest in the user and become appurtenant to the land irrigated, and beneficial use be the basis and the measure and limit of the right.

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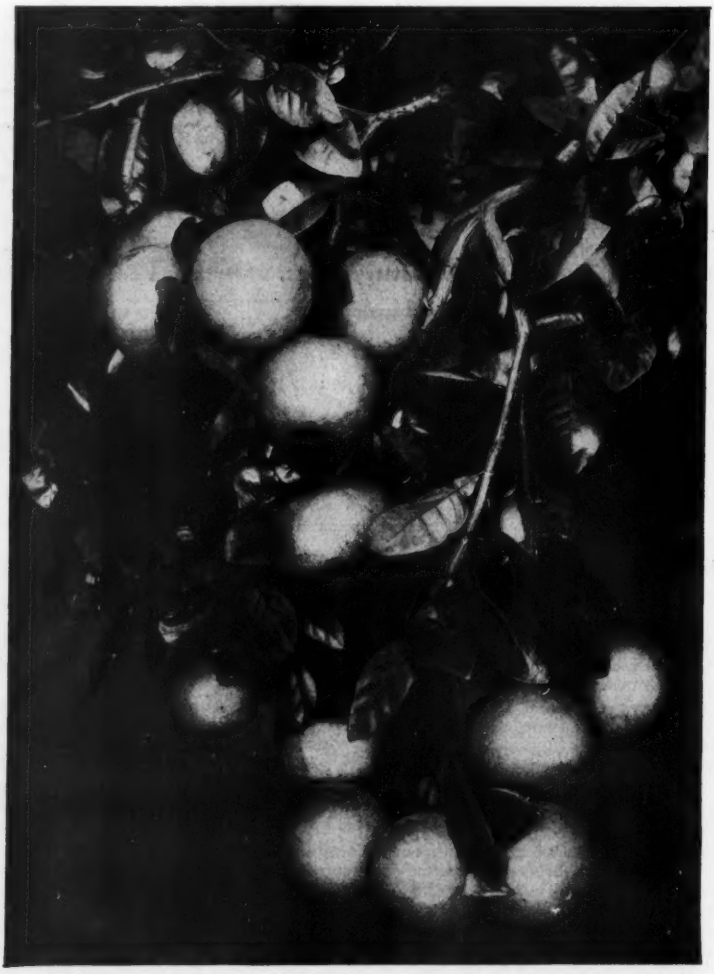

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